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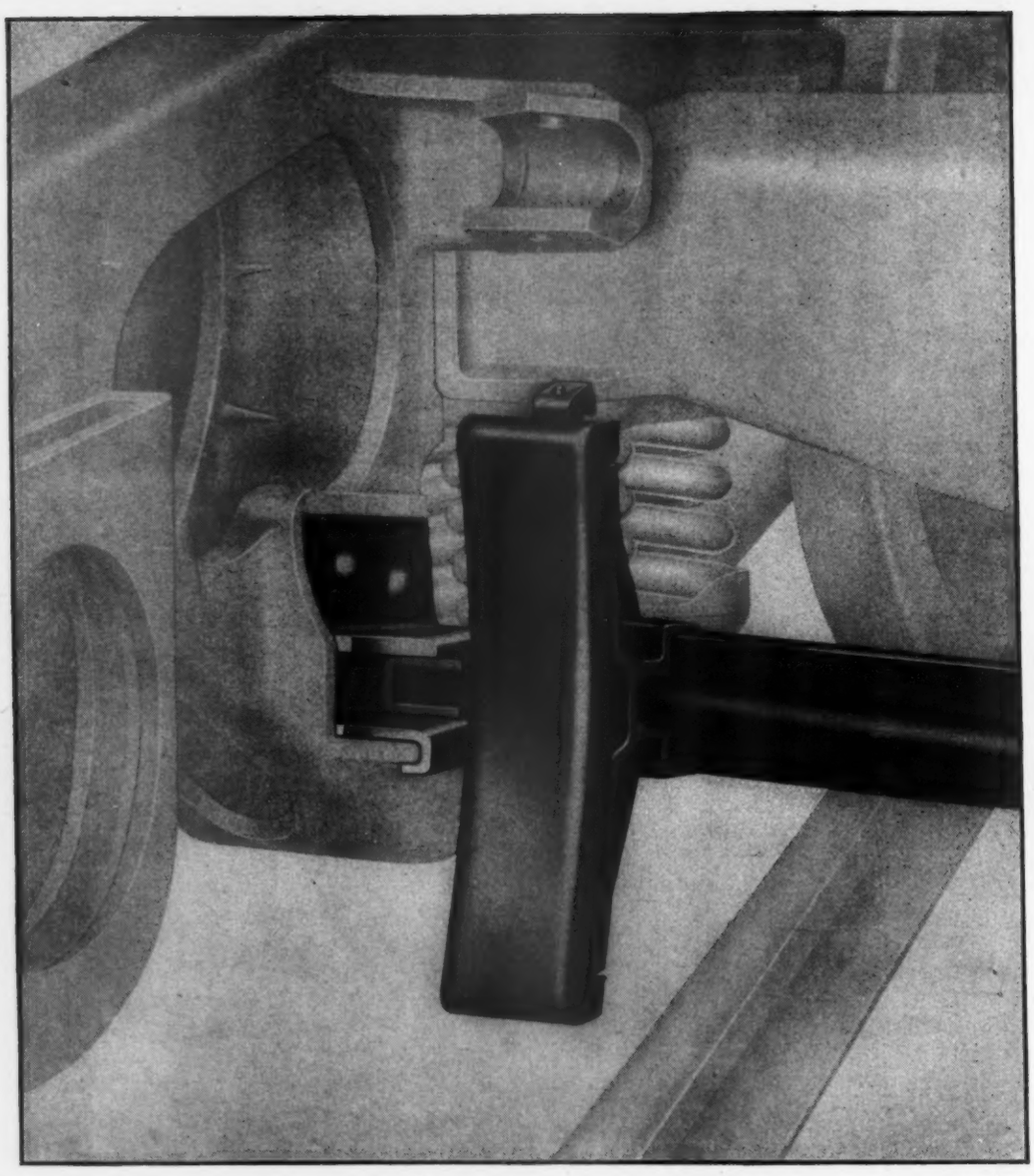

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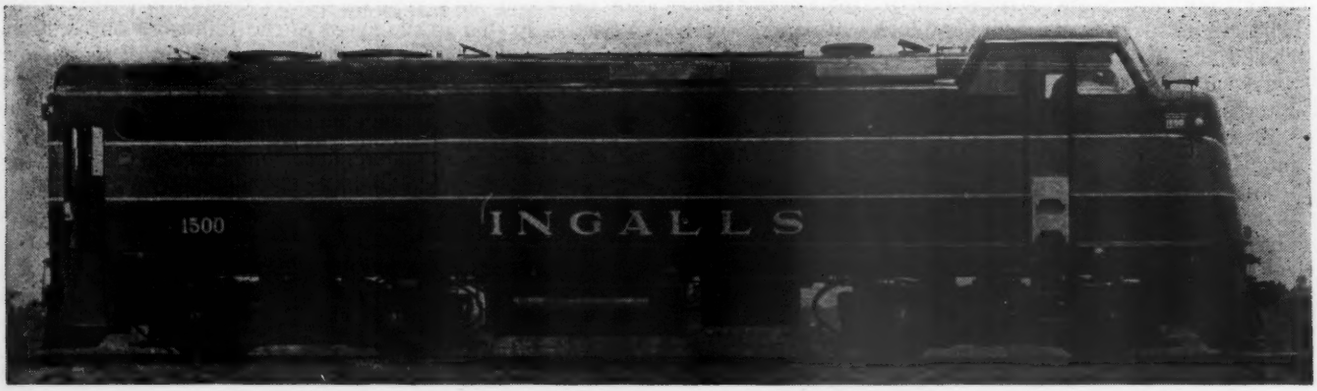
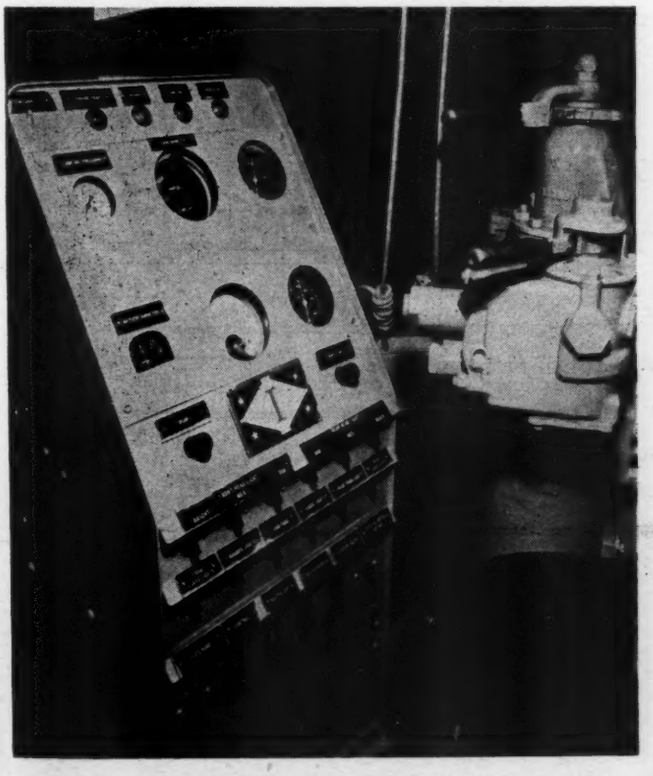


Ingalls Builds

First Diesel Locomotive

All-purpose unit is powered by eight-cylinder Superior engine and has Westinghouse electrical equipment — 1,500 net horsepower available to main generator for traction

A 1,500-HP. Diesel-electric locomotive has been designed and built by the locomotive division of the Ingalls Shipbuilding Corporation, Pascagoula, Miss. This unit is an all-purpose model developed for use either in heavy switching and transfer service or for freight and passenger road service. A feature of the body construction is the turret-type cab that permits 360-deg. vision. The locomotive is adaptable for use in road and suburban service where it is impracticable to turn the locomotive around, because it may be operated in either direction and has a pilot at either end. It can be used either singly or in multiples of two, three, or four units. For multiple operation jumper and air connections are installed.



Engineman's instrument panel

The locomotive has a starting tractive force of 72,000 lb. and a continuous rating of 42,800 lb. The total weight in working order is 240,000 lb., distributed over four pairs of driving wheels.

The body and underframe are of all-welded steel construction. The center sill is constructed of 14-in. H-beams with a heavy plate welded across the top and bottom, making it, in effect, a box girder. The trucks are of the swing-bolster type, each having eight triple-coil springs and two quadruple full elliptic springs. Both trucks have two axles each with a traction motor geared to each axle. The axles have 7-in. by 14-in. journals mounted in Timken roller bearings. The 42-in. wheels, as well as the axles, were supplied by the Standard Steel Works. The truck frames were furnished by the General Steel Castings Corporation.

The Diesel Engine

The locomotive is equipped with a 1,650-hp. Diesel engine made by the Superior Engine Division, National Supply Company. It is a four-cycle turbo-charged en-

gine operating at 660 r.p.m. The engine delivers 1,650 hp. but after the power for driving auxiliary equipment is deducted, 1,500 net horsepower is available at the generator for traction purposes.

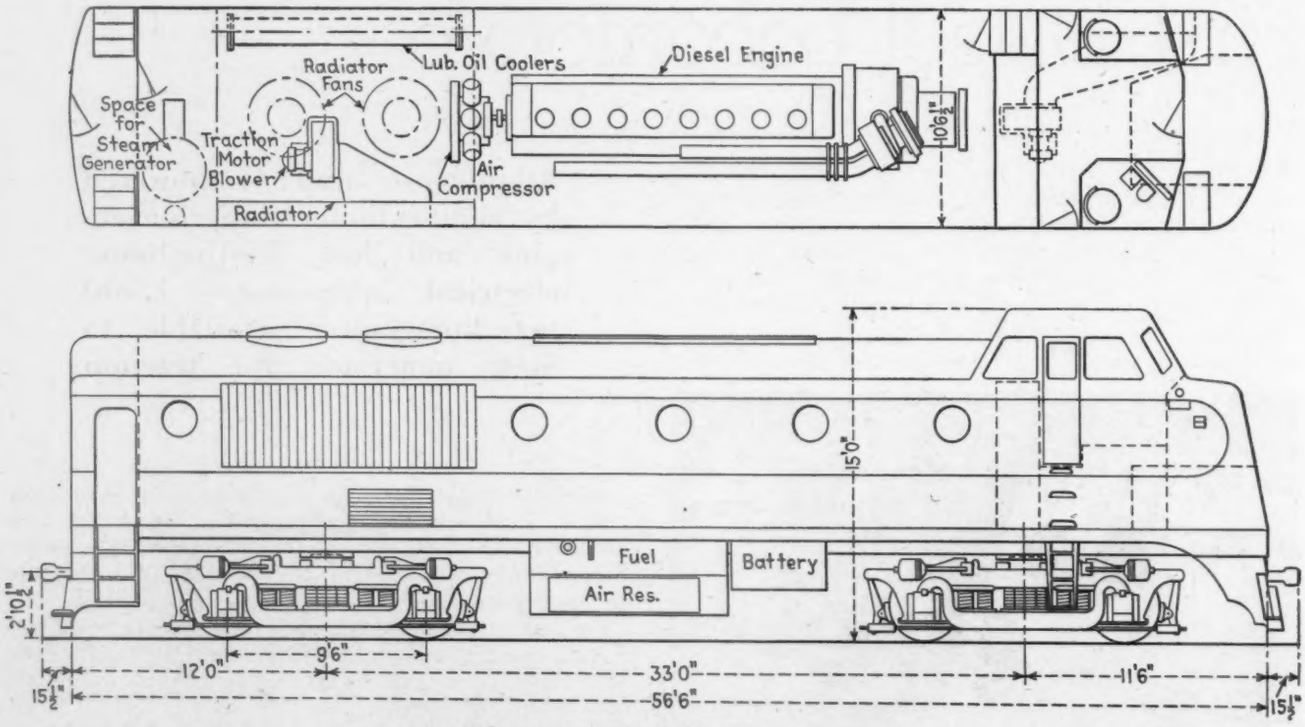
The Diesel engine has eight cylinders with a bore of 12½ in. and a stroke of 15 in. The engine bed, block and cylinder heads are steel castings and the engine bed is extended to provide a rigid support for the generator. The engine uses a dry cylinder block with individually-cooled cast-iron liners. The dual intake and exhaust valves are of heat-resisting steel with seat inserts and are interchangeable. The engine has cast-iron oil-cooled pistons and a forged one-piece crankshaft. A water-cooled manifold of the Helixhaust type is used.

Individual fuel injection pumps are actuated by a chain drive from the engine crankshaft, while the fuel supply pump is driven by an electric motor. Water and lubricating oil pumps are built into the engine. A Woodward hydraulic variable speed governor is used in association with Westinghouse auto-load control. The usual alarms protect the lubricating oil and water cooling systems, and, in addition, the Bearing Watchdog system, manufactured by the Paxton Diesel Engineering Company, is installed. This system will shut off the engine in the event of excess wear or failure of the bearings. An Elliott-Buchi turbo-charger is attached to the engine, taking the air through a filter. At the end of the engine opposite the generators is a flexible coupling for driving a Westinghouse 3-CD air compressor.

Cooling Radiators

Straight fin-tube type radiators are used on each side of the locomotive. Each radiator is built in two separate sections so that in the event of the failure of one section, the locomotive will still have three-quarters of its cooling capacity left. The radiators are proportioned so that the locomotive could continue to operate at full power in the event of such a failure. The cooling air passes through the radiators into an air duct and through two cooling fans located in the roof. The cooling fans are driven by variable-speed electric motors with Minneapolis-Honeywell automatic shutter control, making it possible to obtain close regulation of water temperatures. After the water is cooled in the radiator system, it passes through an oil cooler of the shell and tube type. The water, after serving to cool the lubricating oil, returns to the engine. For cleaning the lubricating oil, a Purolator duplex oil strainer is used, as well as a four-element Nugent waste packed filter.

Space adjacent to the radiators is available for a steam generator and a roof hatch permits its installation or re-



Plan and elevation of the Ingalls Diesel-electric locomotive

Ingalls 1,500-Hp. Diesel-Electric Locomotive

Gauge, ft.-in.	4-8½
Diesel engine:	
One, 8-cylinder in-line, supercharged, hp.	1,650
Driving motors:	
Number	Four
Maximum speed (worn wheels), m.p.h.	65
Gear ratio	15:63
Type	370-F
Journal bearings, in.	7 x 14
Wheels:	
Driving, pairs	Four
Idling, pairs	None
Diameter, in.	42
Wheelbase, ft.-in.:	
Truck	9-6
Total locomotive	42-6
Total weight, lb.:	
In working order	240,000
Light	225,000
On drivers	240,000
Maximum overall dimensions, ft.-in.:	
Width	10-6½
Height	15-0
Length (inside knuckles)	59-1
Tractive force, lb.:	
Starting, at 30 per cent adhesion	72,000
Continuous rating, at 10.5 m.p.h.	42,800
Minimum radius curvature, locomotive alone, ft.	150
Supplies (total capacity), gal.:	
Lubricating oil	157
Fuel oil	1,000
Engine cooling water	480
Heating boiler water	1,200*
Sand, cu. ft.	27

* If and when a heating boiler is installed.

moval. The locomotive will be equipped with a 1,200-gal. water tank if the steam generator is required. At the rear of the locomotive is a vestibule, the purpose of which is to provide a sheltered location for switching crews while operating in transfer service and to eliminate the necessity of their riding in the cab.

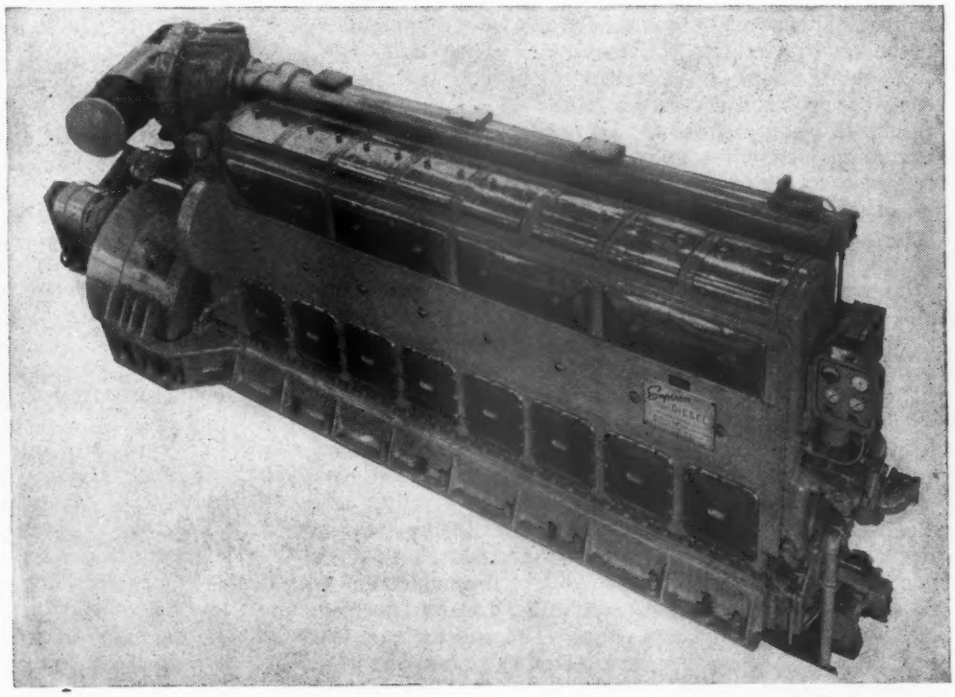
Electrical Equipment

All electrical equipment was manufactured by the Westinghouse Electric Corporation. There are four generators—the main generator, the fan generator, exciter, and auxiliary generator. The main generator is attached directly to the engine crank shaft, and is mounted on an extension of the engine bed plate. It develops 750 volts

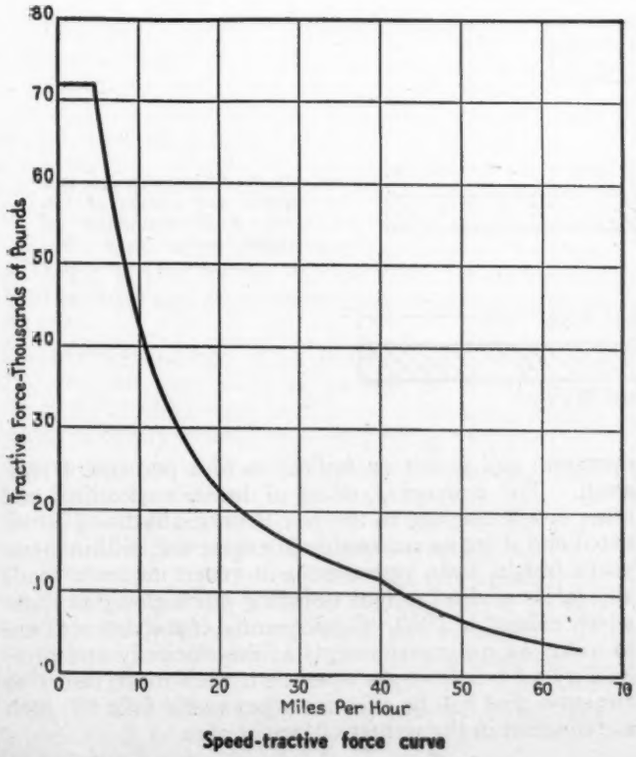
(*Text continued on page 298*)

Partial List of Material and Equipment on the Ingalls Locomotive

Axles	Standard Steel Works Division of Baldwin Locomotive Works, Philadelphia, Pa.
Batteries, storage	Electric Storage Battery Co., Philadelphia, Pa.
Bearings, roller	Timken Roller Bearing Co., Canton, Ohio
Bell and ringer	Railway Service & Supply Co., Indianapolis, Ind.
Blowers, traction-motor	Buffalo Forge Co., Buffalo, N. Y.
Brake, hand	Ajax-Consolidated Co., Chicago
Brakes, air	New York Air Brake Co., New York
Castings, truck	General Steel Castings Corp., Eddystone, Pa.
Compressors, air	Westinghouse Air Brake Co., Wilmerding, Pa.
Cooler, oil	Ross Heater & Manufacturing Co., Buffalo, N. Y.
Couplers	National Malleable and Steel Castings Co., Cleveland, Ohio
Coupling, flexible	Falk Corp., Milwaukee, Wis.
Diesel engine	Superior Engine Division of National Supply Co., Springfield, Ohio
Doors	Morton Manufacturing Co., Chicago
Draft gear	National Malleable and Steel Castings Co., Cleveland, Ohio
Electrical equipment	Westinghouse Electric Corp., East Pittsburgh, Pa.
Extinguishers, fire	C-O-Two Fire Equipment Co., Newark, N. J.
Fans, cab	Westinghouse Electric Corp., East Pittsburgh, Pa.
Filter, oil	William W. Nugent & Co., Chicago
Footboards	Morton Manufacturing Co., Chicago
Gauges	Jas. P. Marsh Corp., Chicago
Hangers, swing	West St. Louis Machine & Tool Co., St. Louis, Mo.
Headlight	The Pyle-National Co., Chicago
Horns, air	The Leslie Corp., Lyndhurst, N. J.
Heaters, electric cab	Edwin L. Wiegand Co., Pittsburgh, Pa.
Motor, traction-motor blower	Westinghouse Electric Corp., East Pittsburgh, Pa.
Pads, engine mounting	Fabreeka Products Co., Inc., Boston, Mass.
Paint	Railway Paint Division of Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Radiators and fans	American Blower Corp., Detroit, Mich.
Rigging, brake	American Steel Foundries, Chicago
Sanders	Ajax-Consolidated Co., Chicago
Seats, cab	Heywood-Wakefield Co., Gardner, Mass.
Shoes, brake	American Brake Shoe Co., New York
Shutters and shutter control	Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Speedometer	Westinghouse Electric Corp., East Pittsburgh, Pa.
Springs	American Steel Foundries, Chicago
Strainer, oil	Puralator Products, Inc., Newark, N. J.
System, crankshaft bearing protection	Paxton Diesel Engineering Co., Omaha, Neb.
Thermometer	Jas. P. Marsh Corp., Chicago
Treads, safety walk	J. M. Edwards Co., New Orleans, La.
Treads, step	Morton Manufacturing Co., Chicago
Valve, emergency fuel cut-off	Manning, Maxwell & Moore, Inc., Muskegon, Mich.
Wheels	Standard Steel Works Division of Baldwin Locomotive Works, Philadelphia, Pa.
Windows	Hunter Sash Co., Inc., Flushing, N. Y.
Wipers, windshield	C. A. Sprague Devices Co., Michigan City, Ind.



The power plant is an eight-cylinder supercharged Superior engine delivering 1,500 horsepower to the main generator



Speed-tractive force curve

Lightweight Freight Cars

A Corrective for High Tare*

By A. F. Stuebing†

Review of upward trend in car capacity since 1920 which was accompanied by a slight reduction in average car load—High-strength steel for lightweight construction offers means of preventing resumption of former trend during postwar years

THE only profitable part of freight operation is hauling revenue payload; moving dead weight is merely a source of expense that should be kept to the minimum in all classes of trains. The early analysts of railroad operation stressed the desirability of heavy tonnage in freight trains. In the last twenty years, more emphasis has been placed on gross ton miles per train hour. Both of these standards are oversimplified, because they do not take account of the relation between dead weight and lading. This relationship between dead weight and lading is the key to operating efficiency.

A short review of operating conditions will help to show the problems involved. In 1920, the average freight train on Class I railroads had a total weight of 1,443 tons excluding locomotive and tender, and consisted of 35.6 freight carrying cars. The weight of the train was made up of 650 tons of revenue load, 58 tons of non-revenue load, a total of 708 tons of lading, plus 735 tons representing the weight of the cars themselves. The ratio of dead weight of cars to the combined weight of revenue and nonrevenue load was 104.4 per cent.

In the next twenty years, train tonnage increased almost continuously and in 1940 the total train behind the tender weighed 2,047 tons and contained 49.7 cars. The total weight consisted of 781 tons of revenue load, 68 tons of non-revenue load, 849 total tons of lading and 1,198 tons weight of thecars themstlves. The ratio of dead weight to lading had increased to 141.1 per cent.

The unprecedented volume of traffic during the war resulted in new records for train tonnage. In 1944 the average freight train weighed 2,409 tons and contained 53 cars. The revenue load was 1,068 tons, an increase of 37 per cent in only four years. The non-revenue load was 70 tons, the total lading 1,138 tons, and the ratio of dead weight to load was 111.7 per cent. Changes in the weight of lading and dead weight in freight trains are illustrated by Fig. 1.

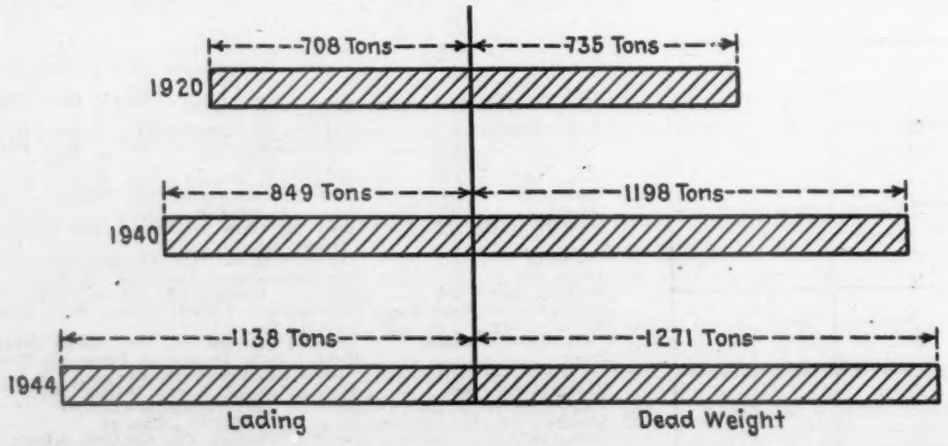


Fig. 1—Changes in the proportion and amount of lading and deadweight in freight trains since 1920

When evaluating the statistics of frelght service prior to and during the war, special allowance must be made for the unusual conditions since 1941 and especially the regulations of the Office of Defense Transportation. For example, rules were established which increased the minimum tonnage for l. c. l. cars, and this reduced merchandise l. c. l. loading from 8,039,515 cars in 1941 to 5,536,792 cars in 1942. Similar insistence on heavy loading of carload freight increased the net tons per loaded car from 27.6 in 1940 to 32.7 in 1944, or 18 per cent in only four years. During the same period, the ratio of empty to loaded car mileage was reduced from 61.8 to 52.0 and the average haul of freight, considering the railroads as one system, was extended from 361 miles in 1940 to 473 miles in 1944. These changes, of course, were largely responsible for the decrease in the ratio of dead weight to payload in freight trains.

Railroad officers are pleased to see the proportion of net ton miles in freight trains increase, but the improvement from 1940 to 1944 resulted from abnormal operation and is not an indication of a permanent situation. The temporary effect of heavy carloading and other conditions due to the war is gradually being eliminated and it seems reasonable to expect that within a few years freight train operation will revert to train loads and ratios of dead weight to lading much closer to those which existed in 1940. Consequently, if the railroads are to make lasting improvements in the efficiency and profitability of freight train operation, they must resort to measures that will be effective when traffic falls off, such as reduction in the weight of freight cars.

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* Paper presented before the Railway Club of Pittsburgh, Pittsburgh, Pa., March 28, 1946.

† Assistant to manager of sales, High-Strength Steel Division, Carnegie-Illinois Steel Corporation.

Capacity Increase Not Utilized

One of the noteworthy changes made in freight equipment during the past twenty-five years to decrease car mileage and the number of freight cars required has been the increase of average car capacity from 42.4 tons in 1920 to 50.0 tons in 1940 and 50.8 tons in 1944. As car capacity increases, the ratio of dead weight to maximum permissible lading generally decreases. Surprising though it is, the average load of carload freight not only failed to keep pace with the increase of capacity in the twenty years prior to the war but decreased from 29.3 tons in 1920 to 27.6 tons in 1940. The proportion of capacity actually utilized decreased from 69.1 per cent to 55.2 per cent.

The increase in capacity of freight cars was accompanied by heavier dead weight, from 20.1 tons average per car in 1920 to 23.7 tons in 1940. An average of 1.7 tons less load with 3.6 tons more car weight resulted in an undesirable increase in the per cent of the tonnage in freight trains made up of the dead weight of cars.

It would be desirable to know how much saving can be effected by reduction in the weight of freight cars, but as yet no agreement has been reached on a method by which the decrease in expenses can be estimated. Several discussions of the economics of light weight equipment and exhibits in railroad rate cases have shown figures for the annual saving per ton of weight reduction, most of which are between $10 and $32. An estimate for one railroad applied to box cars showed an annual saving of $3.06 per ton, if the lightweight car cost no more than the conventional car. Evidently this estimate has not been accepted because 30,000 lightweight high strength steel box cars have been built, some by the identical road to which this estimate applied. In the absence of reliable specific data, railroads are acting on the basis that common sense proves that the cost of hauling extra dead weight is a substantial part of all transportation expenses.

Overall figures, such as those previously quoted, obscure the influence of certain types of cars and further details cannot ordinarily be determined from standard statistics as published. However, some special data contained in an Interstate Commerce Commission report on rail freight service costs gave detailed information on carloadings by type of car for the year 1939. In that year the average weight of revenue carload freight in box cars was 24.6 tons and of less than carload freight 5.4 tons, the average for all loads being 19.5 tons. About 12 per cent of non-revenue freight tonnage, or 15 per cent of non-revenue net ton mileage, was also hauled in box cars. From the statistics the conclusion can be reached that in 1939 about one-fourth of all box cars, with nominal capacity of 44.5 tons, were hauling average loads of 5.4 tons. The loading in that service was therefore 12 per cent of carload capacity and about one-fourth of the dead weight of the car.

The average mileage of all freight cars in 1939 was 11,796 and box cars made an average of 11,635 miles, of which 8,715 miles were loaded and 2,920 miles empty, the ratio of empty mileage to loaded being 33.5 per cent.

Hopper and gondola cars are subject to operating conditions distinctly different from those for box cars. In 1939, the average nominal capacity of hoppers and gondolas was 55.7 tons and the average load carried 50.6 tons. These open top cars utilized 90.8 per cent of the available rated capacity, whereas box cars used 55.3 per cent when handling carload freight and only 12.1 per cent when in l. c. l. service. The average mileage of hopper and gondola cars in 1939 was 8,137, about 30 per cent less than the average box car mileage. The ratio of empty to loaded mileage was high, 85.7 per cent, so the average open top car made 4,832 miles loaded and 3,755 empty.

If similar statistics for other years were available, the causes of the trend toward increase in the ratio of dead weight to payload could be analyzed more thoroughly. The available data on carloadings indicate that shippers of bulk commodities utilize additional cubic space or weight capacity in both open top cars and box cars. However, the competition of highway trucks has taken from the railroads approximately one-half of the tonnage of l. c. l. freight transported. Therefore, the average tonnage of l. c. l. shipments per car decreased markedly from 1920 to 1940 while the capacity and weight of box cars were increasing. The importance of the low l. c. l. factor of utilization of car capacity in railroad freight transportation is evident from the fact that l. c. l. loadings made up 21.2 per cent of all carloadings doring 1940 and more than 25 per cent of the total in 1938.

Lightweight Cars a Corrective

Because box cars are so heavy in relation to the normal loading, many railroads are adopting high-strength steel for box-car bodies, and more than 30,000 of such cars are in service. An interesting illustration of the change from conventional to high strength steel is provided by cars recently built by the Pennsylvania Railroad. The conventional 50 ft. 6 in. riveted box car of copper steel construction, class X-38, weighed 55,300 lb. A car of high strength steel, of the same dimensions and equal cubic capacity, assembled largely by welding, designated X-41, weighs 45,400 lb. This car has trucks which weigh 2,650 lb. less than those on the X-38. The weight reduction in the body alone due to the use of high strength steel and welding is 7,240 lb.

The adaptability and versatility of high-strength steels are shown by the variety of the equipment in which they were applied. Designers of box, automobile and refrigerator cars have used these steels in various combinations of spot-welded, fusion-welded and riveted constructions, which in general are intended to provide strength equal to that of conventional cars with a substantial reduction of dead weight.

Hopper, gondola and ore cars involve some problems not found in house cars, because open top equipment is often subject to more corrosive conditions, abrasion and abusive service. Some railroads want open-top cars built of high-strength steel with the maximum practical reduction of sections to decrease weight and increase capacity, at the same time aiming for strength and service life equal to conventional equipment. Others use these steels with no reduction of section, to decrease maintenance costs and lengthen the life of the car structure, while many roads choose compromise designs which give both a substantial increase in service life and a substantial decrease in weight.

Because open-top cars can usually carry the maximum permissible tonnage of lading, the advantage of weight saving in equipment is evident, since any reduction in light weight brings an equal increase in the load limit. Car designers and users often ask how much weight reduction can be made in hopper cars without a substantial increase in repair costs or shortening of the cars' service life. The answer to this question will vary slightly for different roads, because it depends on the type of lading and operatiing conditions. Some indications of the serviceability of high-strength steel which has much improved corrosion resistance can be gained from experience with extremely light 50-ton hopper cars weighing 30,500 lb. built by the Pressed Steel Car Company in 1935. In these cars, the sides and ends were reduced

from 3/16 in. to 3/32 in.; the floors, usually 1/4 in., varied from 3/32 in at the top to 5/32 in. at the bottom. After eleven years' service on three roads, not one of these cars has yet required overhauling for replacement of sides or floors.

During the war years, the railroads have demonstrated their ability to operate efficiently and profitably with a large volume of traffic. The trend now is toward more normal conditions and it is opportune to ask: What about the future? Estimates of traffic during the postwar years made by the Interstate Commerce Commission probably provide the best basis for looking ahead.

The I. C. C. Traffic Forecast

In 1939 the Class I railways hauled 43.4 per cent of the total revenue ton miles of domestic freight transportation; in 1943 the railroad proportion was 68.8 per cent.

Table I—Shifts in Domestic Transportation, 1939 to 1943

	Revenue ton-miles (000,000)			Per cent of total	
Type of hauler	1939	1943	Per cent change	1939	1943
Class I railways	333,438	727,075	+118	43.4	68.8
Motor trucks:					
Common and contract haulers	20,500	37,000	+ 80	2.7	3.5
Private trucks	29,700	23,600	- 26	3.9	2.2
Total motor trucks	50,200	60,600	+ 21	6.5	5.7
Water-borne:					
Coastwise and intercoastal	225,896	27,000	- 88	29.4	2.6
Great Lakes	76,312	111,604	+ 46	9.9	10.6
Inland waterways	19,937	25,365	+ 27	2.6	2.4
Total water-borne	322,045	163,969	- 49	41.9	15.6
Pipelines	63,100	105,000	+ 66	8.2	9.9
Airlines, mail express	11	50	+355	.001	.005
Total domestic traffic	768,794	1,056,694	+ 37		

Postwar Traffic Estimates (Interstate Commerce Commission)

Ton-miles (000,000,000)	1947		1948		1949	
for each type hauler	Est. A*	Est. C†	Est. A*	Est. C†	Est. A*	Est. C†
Class I railroads	484.1	438.3	507.0	453.6	529.9	461.2
Intercity, for-hire trucks	30.6	27.2	32.3	28.3	34.0	28.9
Intercity, private trucks	52.2	44.6	56.0	47.1	59.8	48.4
Water-borne, domestic	397.2	361.2	415.2	373.2	433.2	379.2
Pipe lines	110.3	104.9	116.1	109.8	121.9	113.8
Totals	1074.4	976.2	1126.6	1012.0	1178.8	1031.5

* Based on full national employment.
† Based on lowest national employment.

The shift in freight traffic for these years and the ICC estimates for 1947, 1948 and 1949 are shown in Table I.

The ton mileage of water-borne traffic, shown in Table I, is based on the actual water mileage and therefore is substantially more than the increase of railroad ton mileage resulting from the transfer of such traffic to the rails. Since 1923, the trend of intercoastal freight shipment has been downward but coastwise ton mileage increased nearly threefold from 1920 to 1929 and in 1940 was 80 per cent above 1929. In prewar years, about 48 per cent of the coastwise traffic was in the Atlantic, 29 per cent in the Gulf and 23 per cent in the Pacific.

Examination of the trend of traffic carried by various transportation agencies before and during the war indicates that probable decrease in production and resumption of coastal and intercoastal shipping will account for the drop in railroad traffic forecast by the Interstate Commerce Commission.

Substantial increases in the costs of conducting transportation and maintaining facilities occurred during the war. From 1940 to 1944 freight service operating expenses per thousand gross ton-miles went up from $2.36 to $2.86, or 21.2 per cent, despite the 17 per cent increase in train load. Higher wages will certainly bring about another increase in unit costs. In the next few years competition will be intensified and if the railroads are to hold or increase their share of freight transportation above that which they enjoyed in the prewar era, they will be interested in adopting all the practical means of reducing overall expenses. One of the methods which is continually gaining acceptance by more railroads is the use of high-strength steel for freight-car construction, because such materials permit reduction in dead weight of cars and increased potential payload capacity, thereby decreasing the ratio of tare ton miles to revenue ton miles. The most widely used of these high-strength steels, U. S. S. Cor-Ten, has been applied in more than 62,000 freight cars for service in the United States.

A practical demonstration of what can be accomplished with lighter freight equipment built of high-strength steel is shown in Fig. 2. The lower line of this chart shows the ratio of dead weight to load on one railroad that has heavy traffic. Comparing 1935 with 1920, the ratio for this road had risen from .502 to .567 or 13 per cent. In 1935, the installation of lightweight high-strength steel equipment was begun on this road. By 1940, the influence of the new cars had made itself felt to such an extent that the dead weight ratio had dropped from .567 to .456, 19.6 per cent lower than 1935 and 9.2 per cent below 1920. This is the lowest ratio

(*Continued on page 298*)

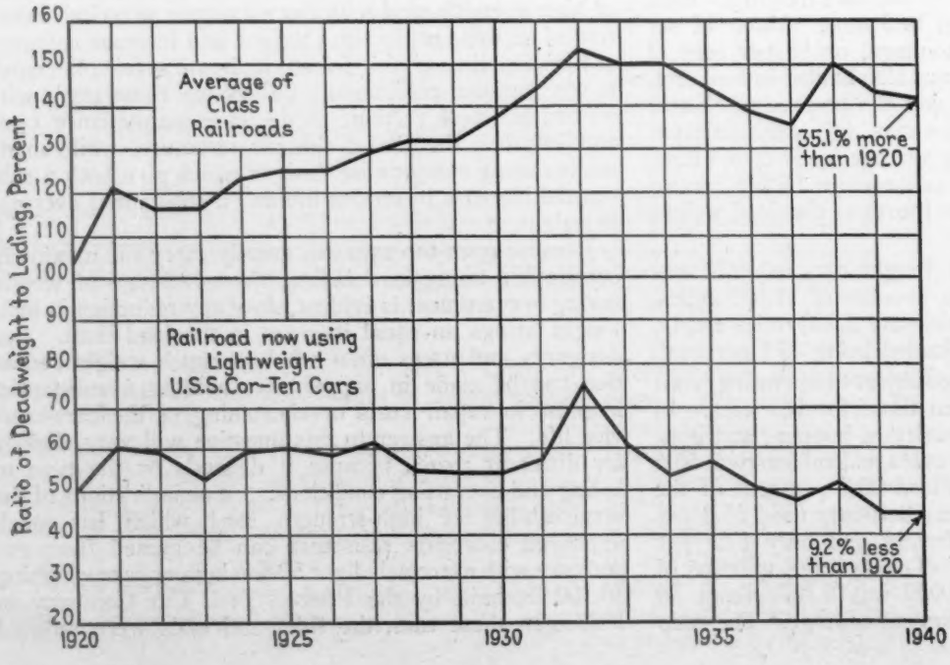
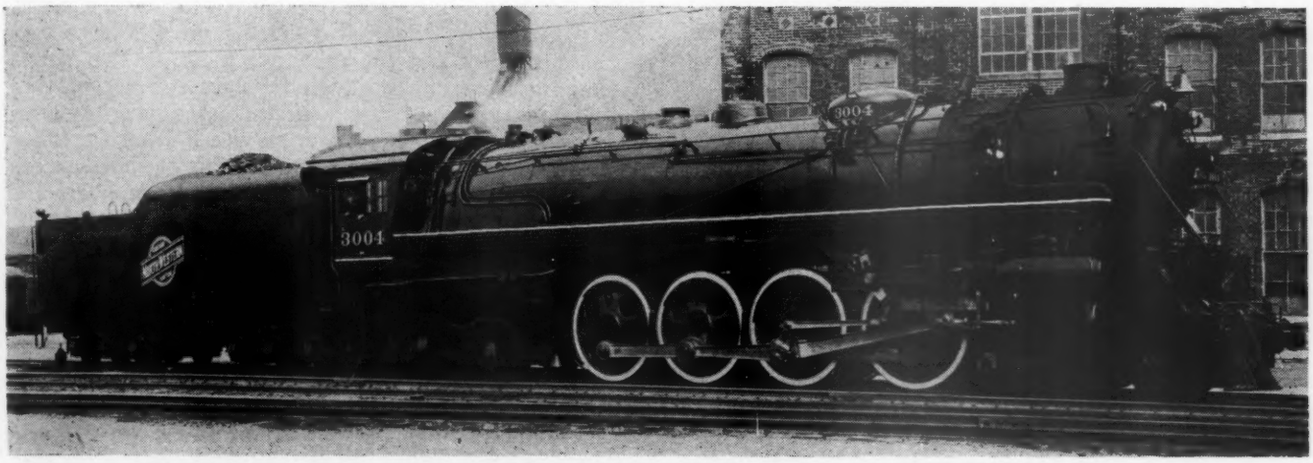


Fig. 2—The effect of lightweight cars on the deadweight ratio

Chicago & North Western

4-8-4 Locomotives Modernized



North Western Class-H locomotive after being overhauled and modernized at the Chicago shops

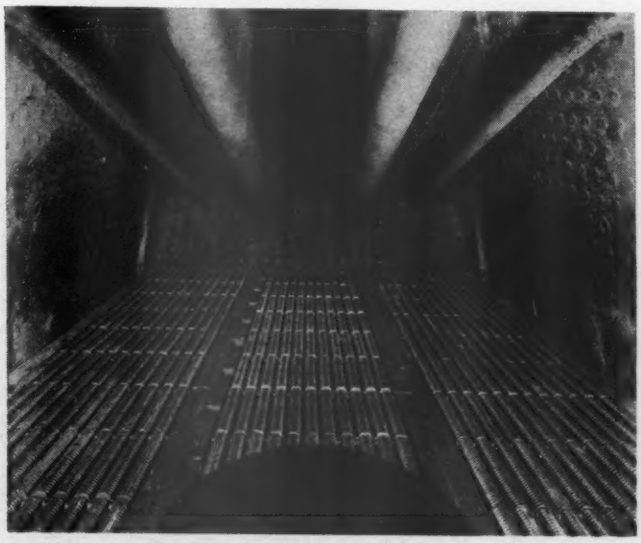
Reconstruction of 35 steam locomotives promises reduced maintenance costs and increased availability—Bed castings, fireboxes and many mechanical details changed

THE Chicago & North Western recently turned out of its Chicago shops and christened with appropriate ceremonies the first of 35 Class-H steam locomotives which this road plans to overhaul thoroughly and modernize in company shops so they will be practically the equivalent of new power and well adapted to meet modern heavy, high-speed passenger or freight service requirements. Improvements have been authorized for the first 20 of these locomotives, which are expected to be put through the shop at the rate of about one a month, once the regular routine of operations is established and materials become readily available.

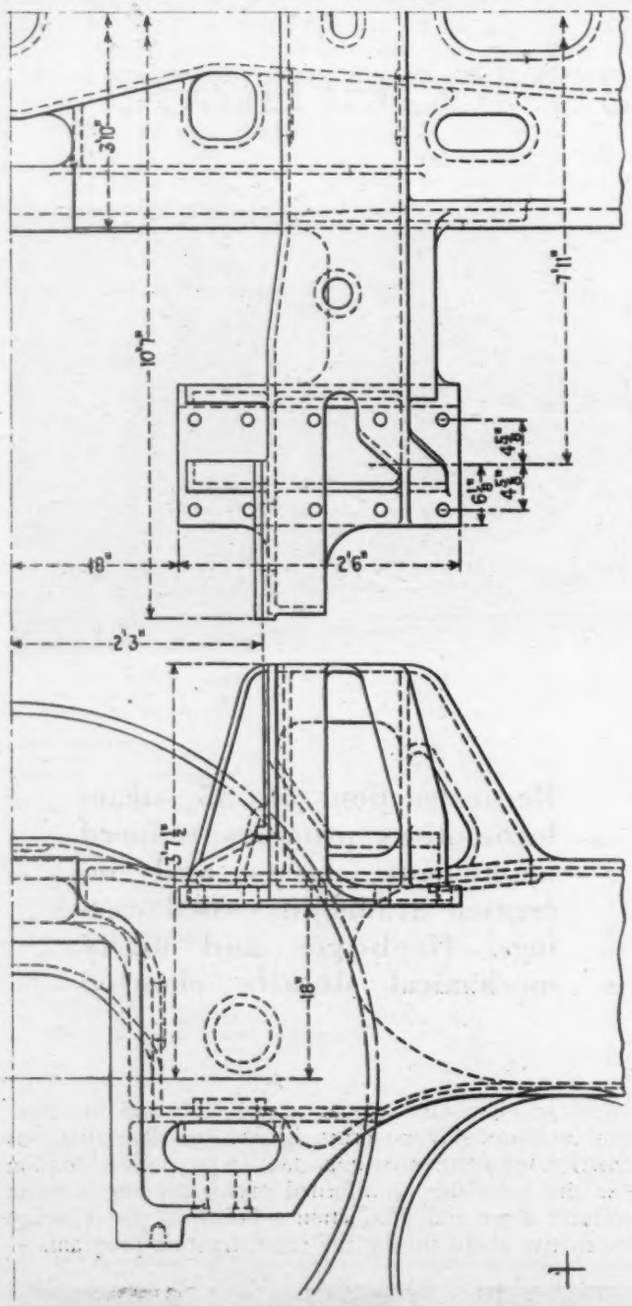
The original Class-H locomotives, built for the North Western by the Baldwin Locomotive Works in 1929, were a heavy 4-8-4 type with 275 lb. boiler pressure, 27-in. by 32-in. cylinders, 76-in. driving wheels, 288,000 lb. weight on drivers and developing 84,200 lb. tractive effort, including 12,400 lb. available with the Franklin booster cut in. They were equipped with Commonwealth bedframes and water-bottom tender frames, Type E superheater, Worthington Type S feedwater heater, and three Thermic syphons, two in the firebox and one in the 5-ft. combustion chamber. The tender was designed to carry 18,000 gal. of water and 20 tons of coal.

Cast-steel bedframes for the Class-H locomotives were among the first cast to this large size and being made 17 years ago, did not include the refinements of design and overall strength now being secured with improved foundry practice and high-tensile alloy steels. As a consequence, these original bedframes were subject to breakage, especially at the expanded cradle frame under the firebox, which sometimes failed even under relatively light shocks. Other details of the locomotive showed weaknesses and caused excessive maintenance cost and out-of-service time at repair shops and enginehouses with attendant serious loss of service mileage.

The management of the North Western was faced with three alternatives, namely: to continue to repair these locomotives in kind; to scrap them and purchase new motive power; or to institute an extensive reconstruction program whereby weaknesses in either materials or design would be eliminated, so far as possible, and the locomotives thoroughly modernized. The last alternative was chosen and among other important factors in this decision was the possibility it afforded of maintaining a more uniform force and production schedule at the Chicago locomotive shops during the reconstruction program.



Hulson grates, and Thermic syphons in the firebox and combustion chamber



Bed-casting bracket which supports multiple-bearing guides independently of the cylinder

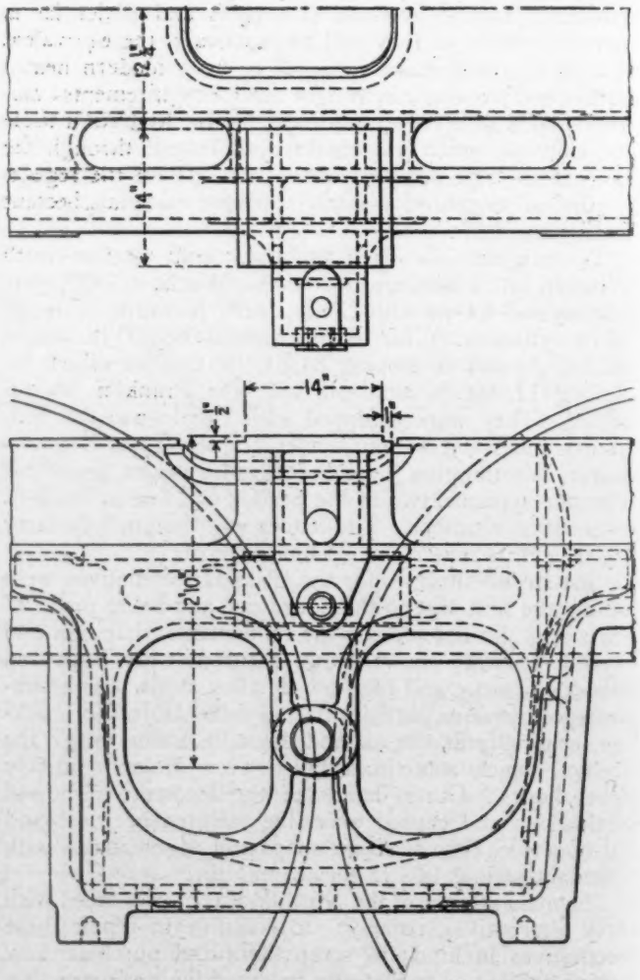
Major Improvements Contemplated

With no change in steam pressure, cylinder size or booster capacity, the tractive force of the improved Class-H locomotive, now known as the Class H-1, is unchanged. Certain alterations in boiler details, however, and especially the enlargement and streamlining of steam and exhaust passages, the use of a larger exhaust nozzle and steam ports increased from 1⅞ in. to 2¼ in. are expected to give a definite increase in horsepower capacity at high speeds. The flexibility of operation and riding qualities of the H-1 locomotive are also definitely improved.

In addition to the new General Steel Castings Corporation nickel-steel cast bedframes with integral back cylinder heads and air reservoirs and straight frames under the firebox instead of the former "banjo" cradle design, major improvements to the locomotive include the application of Timken roller-bearings to all axles, Boxpok driving wheels cross balanced for speeds of 90 miles an hour on 110-lb. rail, Baldwin nickel-steel rods and multiple-bearing crossheads, larger boiler tubes, flues and also superheater units, American multiple throttle and superheater header, an additional Thermic Syphon in the combustion chamber, Hulson tuyere-type grates, improved front end design, and cab support.

Westinghouse air brake equipment is installed, with the foundation brake system divided into two separate units; one set of cylinders operating on the front two pairs of drivers and the other on the rear two pairs. Spring rigging of new design involves the use of Ex-Cell-O pins and bushings with increased bearing area which will not only give longer service life but facilitate renewing the pins and bushings when this becomes necessary. Franklin automatic compensators and snubbers are designed to take up lost motion between the roller-bearing housings and frame pedestal jaws, thus preventing the development of driving-box pound and wear due to this cause. McGill needle roller bearings are used in valve-motion parts including the link trunnions, lifter links, both ends of the radius bars, front ends of the eccentric rods and lower ends of the combination levers.

Force feed lubrication is supplied to all roller-bearing housings and pedestal openings, frame shoes, trailer-truck and engine-truck center plates, link trunnions, main and valve crosshead guides, Franklin floating block between locomotive and tender, and boiler bearings and expansion pads. The provision of ample lubrication for all wearing surfaces, coupled with extensive use of roller bearings is expected to minimize necessary terminal attention and permit operating Class H-1 locomotives for long periods

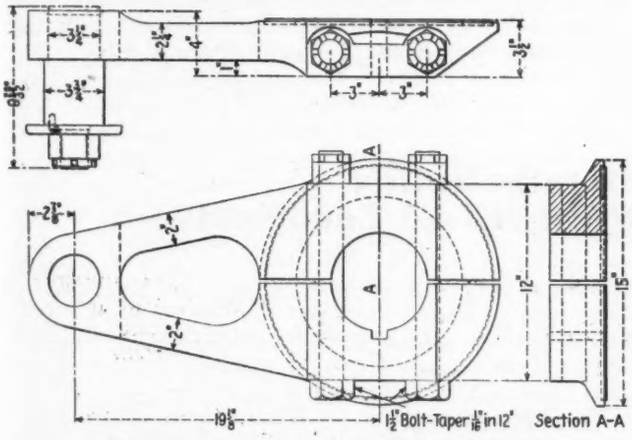


Bedframe extension which replaces waist sheets in supporting the boiler barrel

without major repairs which will be much easier and less expensive to make than with the earlier design.

Principal Changes in the Boilers

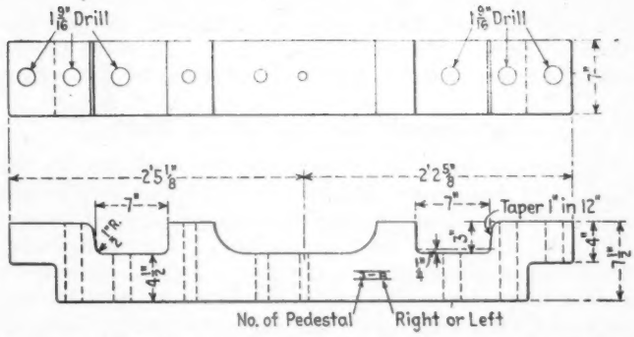
Changes in the Class H-1 boiler include the application of a new all-welded firebox with two Thermic syphons of improved design in the firebox proper and two in the combustion chamber. The back flue sheet has a knuckle radius of ½ in. and is designed for the installation of boiler tubes enlarged from 2 in. to 2¼ in., and flues from 3½ in. to 4 in. The Type E superheater units also are increased in size from 1 in. to 1⅜ in. and connected to a



The new eccentric crank weighs only 190 lb.

new American combination header and multiple throttle in the front end.

The smokebox design has been simplified and improved in certain particulars to give more uniform gas travel and help produce adequate draft with reduced back pressure. Calling the net gas area of 1,338 sq. in. through tubes and flues 100 per cent, the gas areas in the smokebox are as follows: Maximum area under the table plate, 2,040 sq. in., or 153 per cent; minimum area under table plate, 1,074 sq. in., or 80 per cent; area under draft

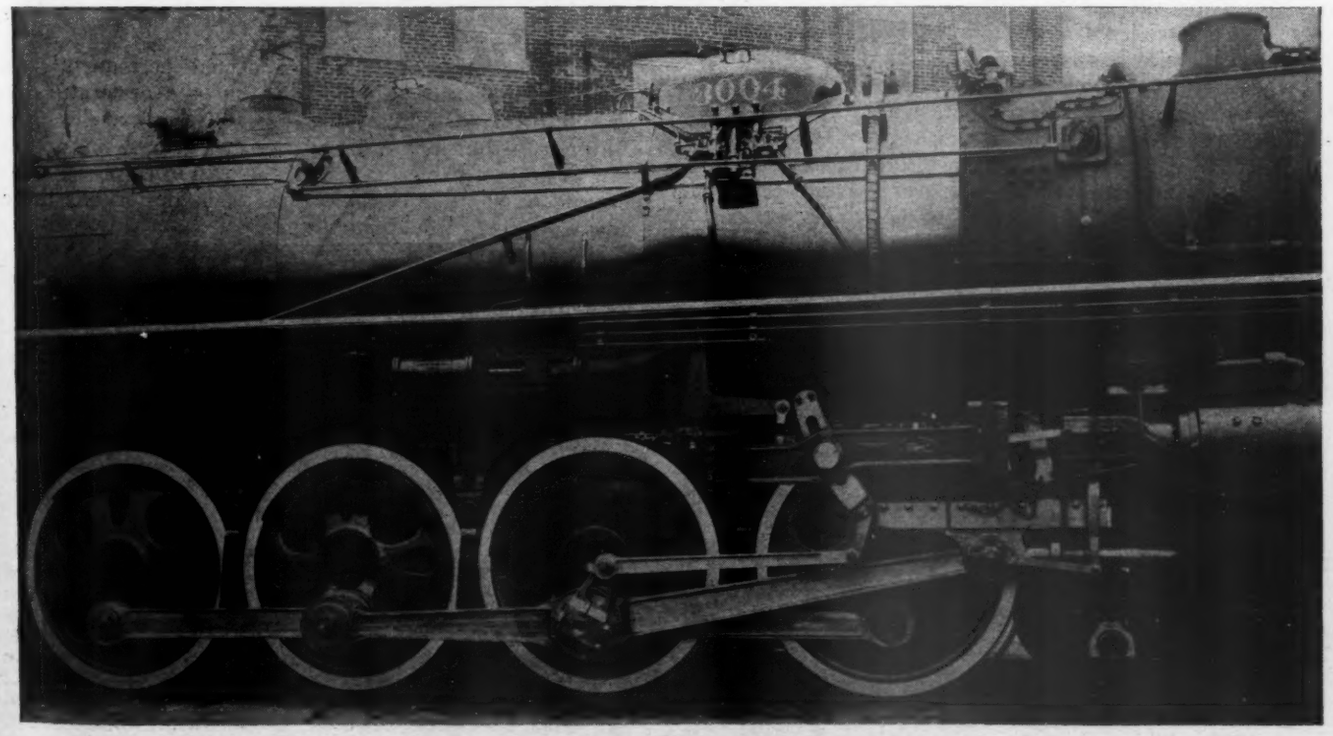


Frame pedestal binders have longer bearing on the toes and larger fillets

sheet, 992 sq. in., or 74 per cent; gas area through netting box, 2,180 sq. in., or 163 per cent; and area of 20⅜ in. stack choke, 24 per cent. The 8⅜-in. conventional round exhaust nozzle with five splitters on Locomotive 3004 has a net area of 32 sq. in. Hulson annular ported exhaust nozzles will be used on subsequent Class H-1 locomotives.

Two waist sheets in the original locomotive have been removed and replaced by a single pair of bearing shoes on a bedframe extension under the barrel of the boiler. The back end of the boiler is supported on four lubricated expansion pads cast integral with the rear bedframe. In order to avoid difficulties caused by expansion, the usual cab connection to the bedframe is dispensed with and the cab is supported entirely from the boiler by the Alco patented cab support, so that the cab and all pipes move with it.

Side boiler checks on the original locomotive are replaced by a single Sellers duplex check valve just ahead of the sand dome on the top center line of the boiler. Ash-pan swipes, connected to the Wilson blow-off cock at each back corner of the ash pan, consist of a pipe extending along each side of the ash pan, capped at the forward end and having a number of short flattened-pipe nozzles directed down the ash pan slope sheets so that these sheets can be readily cleared of ashes when desired by opening



Improvements in wheels, rods, valve gear and guides

the rear blow-off cocks for a short period. An ash-pan thawing device is operated from a 1½-in. valve tapped into the water space on the back boiler head.

Lightweight Reciprocating Parts

Numerous other improvements are included in the Class H-1 locomotive design. For example, lightweight electric-steel pistons are used having Locomotive Finished Materials Company lip-type packing. The manganese-vanadium-steel multiple-bearing crossheads operate in guides supported entirely by frame brackets with no connection to the cylinder. The high-strength nickel-steel rods, supplied by the Baldwin Locomotive Works, include tandem main rods and floating bushings, lubricated through the hollow crank pins.

The eccentric cranks and rods are also of special lightweight design, made of S. A. E. 1030 steel, normalized at 1,550 to 1,600 deg. F. and drawn at 1,550 to 1,175 deg. F. The section 2 in. wide through both sides, shown in the drawing, has been increased from 1 5/16 in. The estimated weight of each eccentric crank, complete with bolts, washer, nuts, etc., is 190 lb. The lightweight eccentric rod weighs 125 lb. The pedestal frame toes and binders are redesigned for greater strength and interchangeability. As shown in another drawing, the length of the toe has been increased to 7 in. and large radii are provided at all corners. Each end of the binder is drilled with three 1 9/16-in. holes to accommodate the two 1½-in. binder bolts and one 1½-in. binder stud, the latter being turned into a tapped hole in the bottom of the pedestal toe. Thus each binder is held securely in place with four bolts and two studs. The drawbars on this locomotive are bushed to give greater service life and ease of repairs.

Wearing surfaces on the valve-gear links and link blocks are flame hardened. The steel valve crosshead guides are bronzed lined. Steel and phosphor-bronze frame shoes of special design are used on the straight pedestal faces. S. A. E. standard threads are used on all valve-gear parts and eccentric-crank bolts in order to permit finer adjustment of bolt and nut tension and still permit inserting split pins without the necessity of backing off the nut.

The controlled lateral-motion device which permitted 2-in. of lateral has been removed from the front driving wheels and ½ in. of free lateral substituted. The front locomotive truck has been rebuilt with 20 per cent resistance rockers instead of 30 per cent. The front pilot beam is another detail part cast integral with the bedframe. All pipes, insofar as practicable, have been welded to eliminate joints and attendant possibility of leakage. A limited number of pipe couplings are used to permit taking off long sections of pipe as a unit in case of lagging removal or extensive general repairs. Vapor cooling coils for compressed air are of the fin-type which effects a substantial decrease in the necessary length of radiation pipe and contributes to a neat appearance and good lines on the side of the locomotive. Graham-White sanders used on this locomotive are equipped with Type-E valves for cleaning the sanders automatically.

Lightweight Cars—A Corrective

(*Continued from page 294*)

which we have found for any railroad and the only known instance of a dead weight ratio for 1940 better than that of 1920. This achievement is particularly noteworthy in view of the fact that Class I railroads, considered as a whole, had an increase of 35.1 per cent in the ratio of dead weight to lading from 1920 to 1940.

The Design Committee of the American Railway Car Institute and the Committee on Car Construction of the Mechanical Division of the Association of American Railroads have been preparing designs of high-strength steel freight cars with a view to having them adopted as alternate standards. It is expected that the forthcoming annual report of the Car Construction Committee will include designs for box cars, 50-ton and 70-ton hopper cars, and fixed-end and drop-end gondolas. This is an indication of the more general acceptance of lightweight high-strength steel freight cars and can be expected to accelerate the adoption of such equipment by roads that wish to adhere to standard designs of the A.A.R.

Ingalls Builds First Diesel Locomotive

(*Continued from page 291*)

maximum, with a continuous rating of 1,760 amperes at 660 r.p.m. The fan generator is attached to an extension of the main generator shaft, and the exciter and auxiliary generators are driven by vee-belts from a sheave on the end of the fan generator.

The traction motors are Westinghouse Type 370-F with a gear ratio of 15 to 63. These motors are cooled by motor-driven blowers, discharging air through flexible connections to the top of the traction motors. The use of the electrically-driven traction-motor blowers makes it possible to maintain motor cooling even when the Diesel engine is idling. Blowers take cool air from the outside, which passes through a screen and baffle filter, producing clean, dry air for the traction motors.

The exciter is of the differential series-field type, and is both separately- and self-excited to produce the desired engine-loading characteristics. It is supplemented by the Westinghouse auto-load system of load control which reduces the generator power demand on the engine, if the engine is unable to develop its normal output for any reason and prevents overloading.

The traction motors are connected permanently in series-parallel only, thus eliminating the apparatus required for transition from series to series-parallel. In addition to the saving in switches and relays, the operation is improved by the steady application of power during the acceleration of the train. At higher speeds there are two stages of field shunting.

The use of conduit has been eliminated on the locomotive. All cable is of the lead- and bronze-armored type with varnished cambric insulation, a type of cable used in marine installation for many years because of its resistance to heat, cold, moisture, oil and mechanical injury. The connections to traction motor leads are made in watertight junction boxes instead of the usual connectors and tubes or tape. Junction boxes and terminal strips are also used for electrical connections throughout the locomotive.

LONG PULL FOR ONE LOCOMOTIVE.—During the German breakthrough in the '44 winter, numerous heavy trains of supplies moved out of the Antwerp (Belgium) docks for forward areas. What is believed to be the largest moved in that area was operated by a crew of the 743rd Railway Operating Battalion, with a single U. S. Army 2-8-0 locomotive hauling 101 loaded cars. The train crew included: T/5 John H. Riley, engineer, of Spencer, N. C.; T/5 Marshall M. Floyd, fireman, from Henderson, N. C., and Sgt. Ralph E. Lowry, conductor, of Cambridge, Ohio. S/Sgt. Vernon L. Taggart, of Memphis, Tenn., was on duty as yardmaster at that time.

Causes and Remedies of

Fires in Diesel Locomotives

By W. S. Wicker *

PROBABLY the most surprising fact about the Diesel locomotive is its susceptibility to damage by fire. When this type of motive power was introduced on the railroads almost everyone felt that loss or damage from fire would be the least serious of all the accidents which might be encountered with it. The belief was general that now we had a piece of equipment about which there was nothing to burn and that Diesel fuel oil, having a flash point above the critical range, did not introduce a serious fire hazard. The manufacturers evidently also felt the fire hazards were nominal, for the only fire protection provided on the locomotives consisted originally of first-aid hand appliances, principally for incipient electrical or oil fires. These consisted generally of a one-quart carbon-tetrachloride extinguisher in each locomotive cab and one or two one-gallon carbon-tetrachloride extinguishers in each engine compartment.

The belief that the Diesel locomotive was invulnerable to loss by fire was soon shattered by serious fire damage to a locomotive on a test run in the Southwest. There were extenuating circumstances, consisting of a broken hose to temporary auxiliary fuel-oil tanks, in connection with this loss, however, to which the large damage was attributed and the experience did little to dissipate the impression that under normal conditions fires could not occur. Fires of varying degree continued to occur in Diesels until, in a number of cases, exceptionally high losses were experienced because of damage by fire, and even greater losses because the locomotives were out of service for periods ranging up to more than 90 days.

The causes of fires in Diesel locomotives vary from common hazards and carelessness, through inherent hazards of wear and tear, to freakish accidents. It might be well here to review some of the more generally known losses on railroads throughout the United States to show just what may be expected to cause fires in connection with the operation of this equipment.

Failures of Thermal Elements in Switches

Fire is reported to have occurred in the B-unit of a locomotive due to the failure of the thermal element in the high-temperature switch in the A-unit. Steam pipes became heated above the ignition point of the fuel oil and oil-soaked dirt around the lagging caught fire. The hand fire extinguishers were of insufficient volume to extinguish the fire, so the train was run several miles to the nearest shop and the shop fire brigade put out the fire with foam extinguishers. Most of the fire was underneath the locomotive in the vicinity of the fuel tanks and the circumstances would indicate that brake-shoe sparks, rather than overheated pipes, were the underlying cause. Fires have occurred, however, from overheated pipes caused by failure of the thermal elements in the high-temperature and other switches at the flash boilers. The fire damage in this case was between $12,000 and $15,000.

The back-firing of a flash boiler, probably due to the failure of the thermal element in the oil-flow switch, set fire to excessive carbon accumulations. The fire was put out by extinguishers on the locomotive and caused damage of less than $100.

Fire occurred in dust and oil-saturated dirt on overheated steam pipes above the fuel tanks of a Diesel locomotive. The tank exploded and dropped to the ground. The fire was extinguished by the use of carbon-tetrachloride extinguishers after causing damage amounting to between $7,000 and $10,000.

Brake-Shoe Sparks

Sparks from brake shoes ignited grease and oil-soaked dirt on the fuel tanks and trucks. The extinguishers on the locomotive were inadequate to put out the fire which started when the brakes were applied for a station stop and it was brought under control by the city fire department. The damage was between $55,000 and $60,000.

Sparks from the brake shoes set fire to the oil-soaked dirt on the top of the fuel tanks. The fire was extinguished by a city fire department. Damage was between $1,000 and $2,000.

Fire caused by brake-shoe sparks igniting oil-soaked dirt on tanks and trucks caused damage of about $60,000. The unusual feature of this fire was that a section of a tire and flange broke from one idler wheel of a six-wheel traction-motor truck and probably punctured the fuel tank. The train ran 13 miles before the brakes were applied for a station stop. Upon the application of the brakes the rigging was immediately torn loose, further damaging the fuel tank, and leaking oil and oil-soaked dirt were ignited by sparks from the brake shoes.

Fire started by sparks from brake shoes igniting oil and oil-soaked dirt under a Diesel locomotive caused damage of between $140,000 and $150,000 to the locomotive and the adjoining luncheon car.

Short Circuits

A fire started from a short circuit in a traction motor, causing damage of about $40,000. All carbton-tetrachloride extinguishers on the locomotive were used but were of insufficient volume. The fire was extinguished by the city fire department.

Fire occurred in the No. 1 traction motor of a Diesel locomotive due to a short circuit in motor leads. It was extinguished by the city fire department. The damage was nominal.

In some cases where small fires occur in traction motors the carbon-tetrachloride extinguishers are discharged into the blowers in the engine compartment and this forces enough vapor through the traction motors to extinguish the fire.

Fire occurred in the engine compartment of a Diesel locomotive because of a lighted cigarette thrown on the floor behind the fuel pump. This fire was extinguished by the city fire department. The damage to the locomotive was between $1,000 and $2,000.

A piece of a broken brake shoe or a broken rail head punctured the fuel tank on a Diesel locomotive resulting in the loss of fuel and eventually a fire damage. Screen tank guards were designed and installed to protect the fuel tanks against this hazard.

* Chief engineer, Transportation Mutual Insurance Company, Philadelphia, Pa.

A piece of broken rail punctured a fuel-oil tank of a Diesel locomotive and the accident was not discovered until the locomotive stopped from lack of fuel. The question of the advisability of providing fuel-tank guards was investigated by this road.

These losses were picked at random and represent only a small percentage of the number of fires occurring in this type of equipment. They give, however, a general idea of the varying causes of fires in Diesel locomotives and show that large fire losses can and do occur. They also give some idea of what may be expected in future losses unless improvements are made in operational and maintenance features and unless fire protection appliances of greater capacity and effectiveness are provided.

What Are the Remedies?

It is practically impossible to prevent the leaking of fuel oil where screw connections are used. For this reason there will always be some slight leakage of oil around the fueling system of a Diesel locomotive. There is also considerable leakage of lubricating oil around Diesel engines. With such leakages the dust and dirt accumulations on the fuel tanks, trucks and traction motors, air reservoirs and cooling fins, and battery cabinets or water tanks soon become saturated and any source of ignition may start a fire. Thorough cleaning at the end of each run of approximately 1,000 miles is necessary. This cleaning should include the removal of all oil and dirt accumulations on fuel tanks, trucks and traction motors, air reservoirs and cooling fins, battery cabinets or water tanks, center castings except for the lubricating grease at the felt seal at the center pin, and oil on underframes.

The interiors of Diesel locomotives are difficult to clean thoroughly because oil and dirt accumulate around pipes, under pipe guards and around engine and motor bases. The numerous semi-concealed spaces behind cabinets, under cabs and in front ends are used by crews for the storage of combustible materials of every kind, including paper cups, wiping rags, fusees, old clothing, pasteboard mats, etc., and these accumulations add to the fire hazard. The interiors should therefore be cleaned thoroughly at the end of each trip, with particular attention paid to oil, oil-soaked dirt and to combustible materials in semi-concealed spaces.

Smoking should never be permitted in the engine compartments of Diesel locomotives. Conspicuous signs should be painted inside the locomotives where they can be readily seen upon entering the compartments.

The thermal elements in the high-temperature and similar control switches should be replaced at least every six months. Some roads renew these elements every 90 days.

Sparks from locomotive brake shoes are responsible for the fires which have done the most damage to Diesel equipment. It is noted that many of the locomotives set on fire by these sparks were running backwards (B-end first) at the time, thus having the fuel tanks more exposed to sparks than when running in the forward direction. Additional protection of these tanks against sparks when locomotives are operated backwards may merit investigation.

It is understood that some tests are being made with specially designed carbon-insert brake shoes in an attempt to eliminate the brake-shoe spark hazard. These brake shoes will reduce but will probably not totally eliminate sparks.

The one effective way to prevent fires starting from brake-shoe sparks is to bring the trains to a stop with the train brakes, using the locomotive brakes only for emergency purposes. Such stops with train brakes and with slight power application on steam locomotives have been advocated and used on numerous railroads for many years. The weight of a Diesel locomotive on a streamlined train, however, is probably 30 per cent of the entire train weight and, with the high speeds used, it is questionable whether satisfactory station stops could be made with the train brakes alone unless the application was begun much further from the station than is now the practice. However, some railroads are using only the train brakes, as far as practicable, in stopping Diesel-powered trains.

What Is the Best Fire Protection?

The fire-protection appliances originally furnished on Diesel locomotives consisted of a one-quart carbon-tetrachloride extinguisher in each cab and two one-gallon carbon-tetrachloride extinguishers in the engine compartment. Experience has shown that this limited protection is inadequate for many of the fires occurring in this type of equipment.

Some railroads have installed two 20-lb. carbon dioxide extinguishers on each locomotive in addition to the one-quart carbon-tetrachloride extinguisher in the cab. Other railroads have provided 50-lb. carbon-dioxide extinguishers, together with 25 ft. of hose and the usual "horn." The equipping of locomotives with fog nozzles and one-inch hose has been approved by one railroad.

One railroad is working toward the prevention as far as possible of all Diesel locomotive fires, the early detection of fires not prevented and the installation of fire-fighting equipment to extinguish all fires detected. This railroad has equipped one locomotive with a smoke-detection system, together with smoke accumulators over the traction motors and thermostats over the Diesel engines. For first-aid protection two 50-lb. carbon-dioxide cylinders have been installed with the gas piped to hose outlets at the side doors and with about 50 ft. of hose to which a "horn." is attached. In addition, a mechanical foam system of about 3,500-gal. capacity, with outside hose and controls, has been provided.

Some of the railroads have plans for the installation and tests of built-in manual or automatically controlled flooding systems for interior protection. That is to be supplied by multiple 50-lb. carbon-dioxide cylinders with the gas piped to various outlets.

Summary

Summarizing, it is believed in the light of present knowledge of Diesel locomotive fires that (1) built-in foam-making or fog systems are desirable for exterior protection and will have considerable value for the protection of the interiors of Diesel locomotives; (2) built-in systems, either of the high-pressure or the low-pressure carbon-dioxide or fog types, are desirable for interior protection; (3) a smoke-detection and alarm system will enable the train crews to discover fires in their incipiency and thereby be better able to extinguish them before serious damage is done, and (4) appropriate portable extinguishers are necessary.

It is sound engineering practice when designing industrial buildings to allow a certain percentage of the cost to cover the installation of fire-protection equipment. This percentage varies according to the degree of protection desired and the benefits to be derived from its installation, amounting in some cases to 10 per cent or more. The principal benefit to be derived from the installation of adequate fire-protection appliances on a Diesel locomotive is the continuing availability of the locomotive hauling trains, as compared to a possible lay-up of two or three months for major repairs of fire damage.

The expenditure of from one to three per cent of the cost of each Diesel locomotive for the provision of adequate fire protection appliances is a small amount of pay for such availability.

EDITORIALS

Journal Box Lids

Tight journal box lids are generally considered to play an important part in minimizing hot boxes, owing to the exclusion of rain, snow, dirt and other foreign elements which have a known deleterious effect upon lubricating conditions. It may be said that even a tight journal box, well sealed at the front with an effective lid and at the back with a close-fitting dust guard may accumulate water in the interior owing to condensation of moisture in the air when the car and journal box pass from warm to cold temperatures. One thing is sure, however, the moisture content of the box and packing will be vastly increased if the box lid is loose and the car passes through a heavy rain or snow storm.

With a view to supplying factual information regarding the fit of journal box lids on railroad freight cars, the A. A. R. Mechanical Division released under date of April 20 a brief but highly illuminating report of the results of field observations made by members of the Committee on Lubrication of Cars and Locomotives on their respective railroads. Both owned and foreign cars were carefully inspected in this checkup, the minimum car age being 1 year; maximum, 46 years; and average, 23 years. Similarly, the age of the side frames was noted and averaged 19 years.

The total number of journal boxes checked by the committee was 2,671, including 2,243 integral and 428 separable boxes. In general, hinge pin holes were found worn more than hinge pins, the figures regarding condition being as follows: hinge pin holes, 581 good, 941 fair, 1,132 poor; hinge pins, 907 good, 931 fair, 804 poor. Lugs were found out of gage with the face of the box to a maximum of ¾ in. and an average of $^{3}/_{32}$ in. The wear on the face of the lugs reached a maximum of ½ in. and average $^{3}/_{32}$ in.

The "meat in the coconut" is the percentage of contact on the face of the box and, without going into details, 2,100 journal boxes, or roughly 80 per cent of those examined, had less than 50 per cent contact of the lid on the face of the box. On 354 boxes, the area of contact was less than 10 per cent. Not many railroad officers, seriously at least, would advocate operating journal boxes without lids, but the conditions described will let in almost as much moisture and dirt over a period of time.

In examining journal box lids, the check-up mentioned covered a total of 2,660 lids, including 2,172 pressed and 488 cast; 934 roller and 1,723 friction shoe or equivalent. Most of these lids, 1,395 to be exact, opened for insertion of a $^{1}/_{32}$-in. shim at a pull of 0 to 10 lb. and this number rapidly dropped off with increasing pressures to 23 lids requiring 60 to 70 lb., and 4 lids requiring over 100 lb. To pull the lid over the hinge lug to full open position required relatively higher pressures, this being accomplished with less than 10 lb. on only 290 cars, 50 to 60 lb. on 295 cars and over 100 lb. on 167 cars. It would seem that with a reasonably good fit of the lid on the face of the box, any pressure beyond that required to maintain a firm contact throughout the service life of the lid is not only unnecessary but a hindrance to easy journal inspection and servicing.

No Battery Charging?

Since the beginning of practical electric car lighting in 1885, the requirements of terminal battery charging have presented a problem every railroad would like to be without. Charging has been done in most cases by stationary motor-generator sets supplying direct current to outlets in the yards through underground cables, portable charging cables being used between the outlets and the cars. The method requires that the cars stand in the yards through the charging period, it requires a considerable amount of labor, the cables and ducts are subject to rapid depreciation and the system is electrically inefficient. Difficulties have increased, first with the growth of lighting loads and then with the coming of air-conditioning, until, under heavy traffic requirements, it is often necessary to charge as much as possible in the brief time the car is in the yard with the hope the battery will receive enough en route from the car generator to avoid a failure.

The situation has been greatly relieved by the use of three-phase, 220-volt, a.c. standby power systems. In addition to supplying power at terminals for precooling, they are used to charge batteries by means of portable rectifiers, or motor-generator sets, or by equipment on the car. Probably most important in preventing low batteries and for insuring satisfactory equipment performance is the design of car systems which adequately meet operating conditions.

One of the early sources of low batteries on air-conditioned cars was inadequate size of conductors, resulting in low motor voltage, long hours of operation, high electrical losses and, naturally, discharged batteries. Many 32-volt cars have been redesigned to have adequate size conductors and short runs between the battery and the generator and the compressor motor, but higher voltages offer definite advantages, and the trend in new cars is to 64 or 110 volts d.c. or even to a total or partial use of 220-volt, three-phase, a.c. power.

One of the 110-d.c./220-a.c. systems soon to be placed in service is described in the electrical section of this issue. A 110-volt, d.c. generator with an 88-cell battery

supplies an inverted rotary convertor and self-regulating transformer producing 220-volt, three-phase, a.c. power to all motors and 110/220-volt a.c. power for lighting. A receptacle is available for receiving a.c. standby power, but this does not provide for battery charging. When asked about this, the designer stated that their 110-volt cars do not require charging at terminals. That raises the question as to whether it is due to the use of 110-volts, to operating conditions, or to ample generator and battery capacity—but the fact remains—battery charging is not required.

There are other ways of avoiding battery charging. One is head-end power systems, but these, so far at least, have failed to meet general railroad conditions. Individual car supply systems employing propane burning engines to drive compressors and generators have, on the other hand, been eminently successful. One application of Diesel-driven generators did not work out well, but other cars with Diesel-electric power plants are under construction, and are being tested under service conditions. Another type of equipment which will be applied to a number of cars generates from the axle at 110 volts and by means of an Amplidyne invertor supplies 220-volts a.c. for lighting and motors.

Whatever may be the best way to do it, the avoidance of terminal battery charging has obvious advantages. Doing away with charging facilities altogether would probably be impracticable and perhaps unwise, but the evidence now available indicates it might be reduced considerably. It would mean some increase in cost of car equipment, but it should offer definite advantages to the operating department by reducing the time cars are tied up for battery charging and insuring against failure in service. Although operating conditions are different on each railroad, it would appear that some interesting calculations could be made comparing the cost of terminal charging (including the holding of cars for this purpose) against the cost of equipment which would make terminal charging unnecessary.

Good Design Is Engineered

Good design requires a knowledge of engineering principles and the ability to apply these principles to a particular set of conditions. These requirements are usually sufficient to limit the shop equipment or car and locomotive parts that should be designed and built by shop forces to simple structures subjected only to static loads and upon which safety is not dependent. The assumption of an engineer's responsibility by unqualified personnel can be both costly and disastrous.

A designer must know the stresses which each member of a structure will carry and the physical properties of the materials that are to be used in its construction. The stresses can only be calculated when all forces acting on the structure are known; the physical properties are determined by laboratory tests. When varying or dynamic forces are involved, a situation frequently confronting a designer of locomotive and car parts, shop personnel are usually in a position where they must guess at the strength to be built into a particular part. Without test reports they must guess at the strengths obtained with the materials employed. Guessing generally results in a structure that is either unsafe or one that is far stronger than that required for the job. A glance at many of the shop devices is evidence enough that a lot of guessing entered into their design, although, fortunately, they are usually made overly safe.

If a railroad has an adequate engineering staff it should be used and consulted before the shops make any important structure or parts of a structure—even the smallest bolt can be important. If a railroad does not have an adequate engineering staff then it should acquire one—to save time, material and grief.

Better Locomotive Cost Data Are Needed

Throughout its entire existence the steam locomotive has been handicapped, whenever comparisons with competing types of motive power are concerned, in the matter of accuracy of cost data. This is especially true in relation to comparative figures with respect to the Diesel. All other things being equal, Diesel locomotive cost figures are probably more accurate than those relating to steam (1) because more complete records were set up by the railroads; (2) because the principal manufacturer of Diesel-electric motive power developed rather elaborate cost and maintenance records and encouraged the railroads to make use of them and (3) because, in some instances, there were railroad men who wanted to prove that the Diesel could not compete with steam power in the matter of costs.

It seems about time that railroad operating and mechanical department men did some constructive thinking on this subject and, in cooperation with the manufacturers of Diesel-electric locomotives and their appurtenances, developed an acceptable system of keeping operating and maintenance records with respect to steam and Diesel power which could be used by all railroads operating both types of power and which would contain data permitting it to be related definitely to the conditions of operation on a specific road. Operating costs are going to have such an important bearing in the next few years that we can not afford to continue expending the time and effort to produce figures which only serve to conceal facts of real value.

Three items of operating expense stand out above all others; these are wages, fuel and repairs.

Whatever changes affect the wage schedule will affect both steam and Diesel operation and the ultimate effect on the cost of locomotive operation will be influenced largely by the manner and extent of the use of these two types of power.

In the matter of fuel costs, it might be well to look

carefully into the question of how fuel records for motive power are developed. Fortunately, in the matter of Diesel fuel costs, we may assume that they are reasonably accurate for, after all, Diesel fuel is metered fuel. Most every railroad man intimately associated with steam locomotive operation has a fair idea of how accurate the fuel cost figures of steam locomotive operation are with respect to any specific class or group of locomotives. Those who like to argue against the Diesel quite frequently draw attention to the prospect of substantial increases in the cost of fuel oil. It might be appropriate to point out that while the ultimate effect of John Lewis' maneuverings in the bituminous coal field are still unknown, it is reasonably certain that solid locomotive fuel will eventually cost more money per ton. So, also, will the price of Diesel fuel oil eventually find its way to higher levels. Over a period of years, the chances are that both oil and coal will increase in cost at somewhat similar percentage rates.

In the matter of repair costs, there is no real comparison as matters stand today. It is a well known fact that locomotive repair costs, regardless of type, increase with the age of the equipment. Unless modern steam power is used as the basis of comparison with Diesel power—mile for mile and year for year—it is obvious that comparative costs mean very little.

One of the distinct advantages that the steam locomotive has enjoyed has been the relatively low first cost but if the first cost of modern steam units, of either conventional or improved design, continues to increase at the rate which it has in the past five years, and conversely, the first cost of the Diesel continues to decrease with volume production, the spread between the first cost of the two types of power will continually narrow. The steam locomotive can not afford a very much higher cost per horsepower.

Atomic Power

Those who have been inclined to speculate on the future of atomic power—and indeed who has not?—and particularly those who have tried to stretch their imaginations to include the locomotive within range of future applications of atomic power will find it a matter of interest to learn that the subject is in the same speculative state when discussed by the atomic scientist as it is in their own minds.

In the news columns of this issue a brief reference is made to an address by Doctor Enrico Fermi, Professor of Physics, University of Chicago, winner of the Nobel Prize in 1938 for work on bombardment of the atom, which he made before The George Westinghouse Centennial Forum at Pittsburgh on May 17 in which he discussed this subject. The best prediction he offered, is that twenty or thirty years from now, perhaps, "there will be large central installations in which very great amounts of power will be produced and transformed into electrical energy or steam for local power consumption." Because of the necessity of surrounding the "pile" with a heavy shield—for example, a concrete wall several feet thick—"perhaps a large locomotive may be the smallest mobile unit in which an atomic plant conceivably could be installed."

This conservative speculation of an atomic physicist should relieve those now interested in a number of motive-power developments in which atom splitting plays no part of any fear that this amazing new source of energy may "steal their show."

NEW BOOKS

A Chronological History of Electrical Development. *Published by the National Electrical Manufacturers Association, New York 17, N. Y. 154 pages, 6¼ in. by 9¼. Bound in Fabrikoid. Price $2.00.*

It is a story by dates of important happenings in the electrical industry. The manner of presentation is indicated by the following excerpts from the book: "400 B.C. Democritus (460-357 B.C.), Greek Philosopher, propounds the theory of atomic structure of matter, saying atoms are in the perpetual motion and are indivisible." "1819 James Watt (1736-1819), Scottish engineer and inventor, famous for his improvements in steam engine design, dies. In his honor the name 'watt' is given to the unit of electric power." "1836 Samuel Finley Breese Morse (1791-1872) makes his first telegraph instrument from an old picture frame, exhibits it in 1837 at the University of the City of New York." "1839 The first electrotypes are produced from a wood engraving by Joseph A. Adams of New York City. They were published the following year in 'Mapes Magazine'." "1874 Thomas Alva Edison (1847-1931), American electrician and inventor, develops the quadruplex telegraph system, permitting the sending of four messages over one wire simultaneously, two in each direction." "1875 Elihu Thomson (1853-1937), American electrician, operates the first radio set in history, antedating Hertz and Marconi." "1885 George Westinghouse (1846-1914) of Pittsburgh, Pennsylvania, secures the Gaulard (see 1881) and Gibbs (see 1881) patents by which the Westinghouse Electric Company develops and introduces alternating current in 1886." "1889 Charles Proteus Steinmetz (1865-1923) of Germany arrives in the United States and starts work in Yonkers, New York, as a twelve-dollar-a-week electrical draftsman for Eickemeyer and Osterheld." "1944 As of July, television broadcasts are being made from nine stations in the United States—three in New York, one each in Philadelphia and Albany-Schenectady, two each in Chicago and Los Angeles." An appendix includes a list of National Electrical Manufacturers Association member companies, giving the name of the original company, the date of founding, and the name and title of the founder, and of the first president.

Magnaflux Test of Diesel Locomotive Parts*

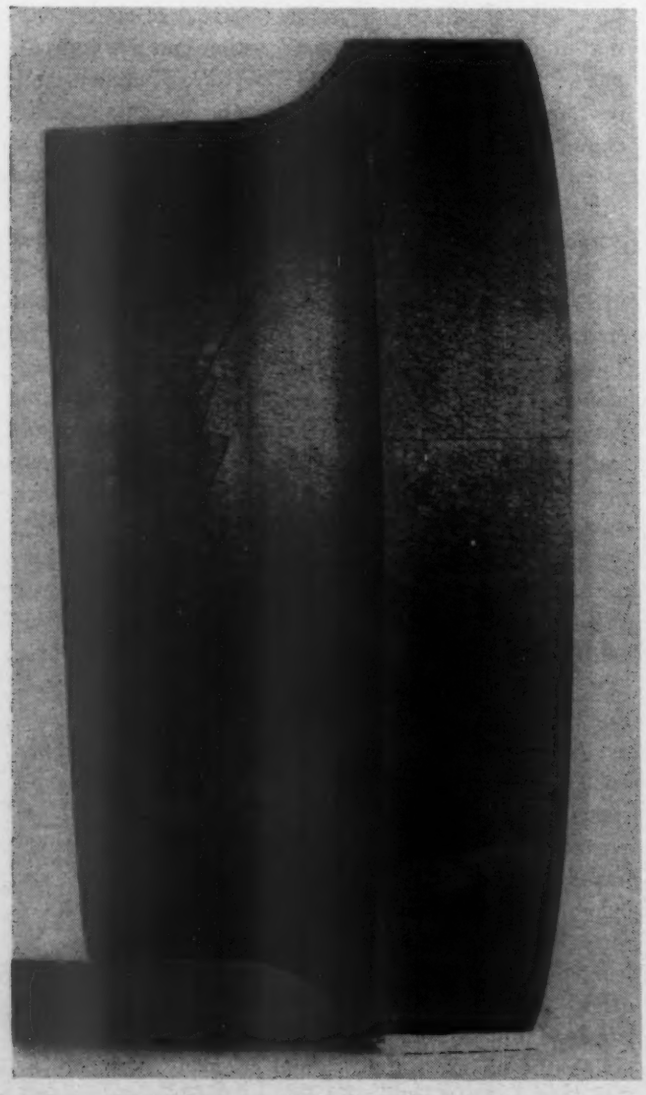
By M. C. Haber†

During the last few years the demand for more dependable methods of checking important locomotive parts has caused the railroads to give greater consideration to results obtained by Magnaflux tests.

In July, 1939, the Union Pacific executed a service agreement and license with the Magnaflux Corporation permitting the use of Magnaflux methods at any point on the railroad. As of January 1, 1946, the Union Pacific has these facilities available at 26 major and secondary shops, including six shops where Diesel-electric locomotives are being maintained.

In order that the highest efficiency may be obtained in the use of Magnaflux equipment, the following instructions are placed in the hands of each operator:

* Abstract of a paper presented at the Railroad Magnaflux Conference, held at Chicago on February 11 and 12.
† Mechanical engineer, Union Pacific.



Etched section of traction motor armature shaft showing fatigue cracks in pinion fit

General Comments

The use of Magnaflux inspection for locating defects in materials is an all-important function and the following instructions will enable Magnaflux operators and mechanical department supervisors to understand thoroughly the correct application and use of this method of testing.

Although the Magnaflux method ordinarily shows defects plainly, it requires great care on the part of the operator in the visual inspection after application of inspection powder to avoid overlooking any defects.

Magnaflux inspection involves the application of two principles: (1) Any sudden interruption in the path of magnetic fields flowing through a piece of material undergoing inspection, such as might be caused by cracks or other structural defects, results in local leakage fields; (2) if small particles of powder having satisfactory magnetic properties are brought in the vicinity of defects these particles are attracted to and held by the leakage fields, and the pattern they form indicates the shape and extent of such defects.

How To Get Maximum Results in Testing

The following important operations are necessary to obtain the full benefit from Magnaflux inspections: (*A*) Consideration of designs and kinds of materials to be examined; (*B*) preparation of parts to be inspected; (*C*) magnetization of parts and application of Magnaflux powder; (*D*) inspection of parts; (*E*) Demagnetization after inspection.

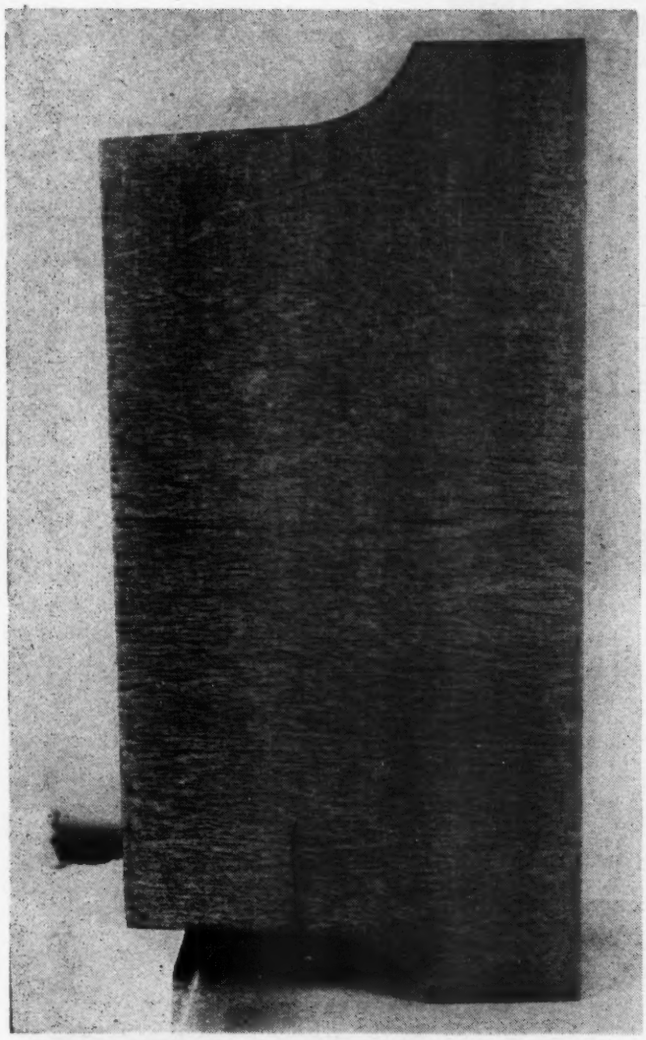
A—The operator should become familiar with parts to be inspected and should know the locations in which defects are most likely to occur.

The smoother the surface to be examined and the more uniform its color, the more favorable are the conditions for formation and examination of the powder patterns.

B—Before the application of inspection powder, parts to be inspected must be dry and all oil, grease and dirt must be removed; otherwise, freedom of the particles of powder to move towards defects is destroyed, defeating the purpose of the inspection. No attempt should be made on the part of the operator to Magnaflux inspect any item of material which has not been properly and thoroughly cleaned. The importance of proper preparation and cleaning of materials before inspection cannot be over-stressed.

Magnetization—Application of Powder

C—Before applying the inspection powder, the first step is to magnetize properly the part to be inspected except on parts which are flat and on which Magnaflux powder will remain by force of gravity. If Magnaflux powder will not fall off it may be applied to the part to be inspected before the current is turned on, and after the part is magnetized, the excess powder may be blown, tapped or shaken off. Magnetizing is accomplished by setting up the magnetic field in the proper direction which should be as nearly as consistent at right angles to the possible defect. The magnetic field should be of proper strength, as indicated by the powder pattern, so that the powder particles will not stand up on end and hide any



Etched planar section of armature shaft showing extent of torsional fatigue cracks in pinion fit

defects present, but the magnetic field must be sufficiently strong to form a definite powder pattern. A high degree of movement of the inspection powder is desirable so that it may assume new positions and definite powder patterns even when the leakage fields set up by defects are very weak.

The strength of the magnetic field can be regulated by the number of turns of cable around the part being inspected or by adjusting the current output from the machine.

It is desirable that the powder used in Magnaflux inspections have a high visibility contrast against the color of the surface to be inspected. Three different colors of powder are available, the pearl gray powder being most satisfactory on practically all surfaces except sand-blasted or other parts which are similar in color to the powder itself. On such surfaces the red or black powder should be used. The pearl gray powder should be used, however, in all cases except those in which sufficient contrast in color cannot be obtained.

The operator should endeavor to secure a thin, well-distributed coating of powder on all parts to be inspected which will produce most satisfactory results.

A powder blower should be used for applying powder. This blower is especially designed ot deliver powder at a low velocity and forms a perfect pattern at locations difficult to reach with a hand duster. For a clear outline of any defects, excess powder should be carefully blown away leaving only a ridge of pattern formed at the flaw. Excess powder must never be blown off by shop air as the velocity will blow away the pattern at the point of defect.

Magnaflux powders have little harmful effect on the skin and membranes of the nose and throat when inhaled, but when this powder is used in an enclosed space a respirator should be used and precautions such as are taken with any kind of dust should be observed.

Inspection of Parts

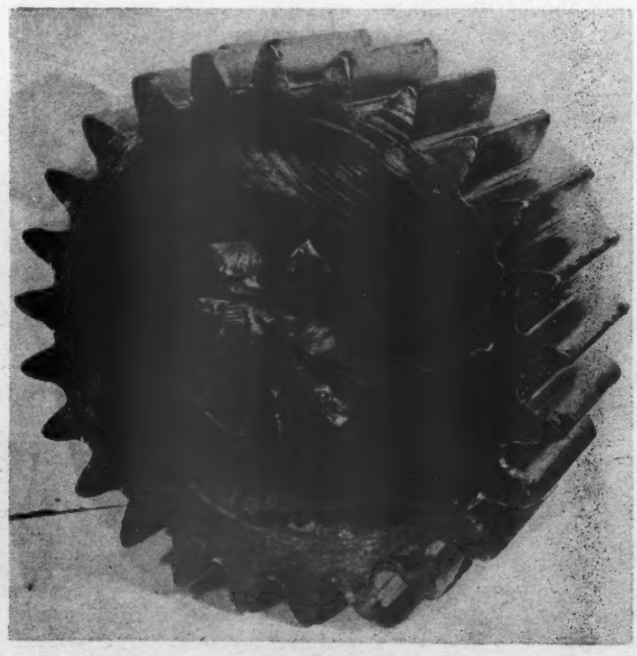
D—The Magnaflux operator must examine the entire surface of the part to be inspected and make certain that he does not pass over any indication of defects which may be extremely small or masked, wholly or in part, by irregularities in surface finish such as holes, indentations or deeply-machined grooves into which possible defects may extend.

Surface cracks are sharp and give the clearest powder patterns which are narrow and well defined; however, other patterns may be of a wide, fuzzy type, indicating sub-surface defects difficult to interpret due to the lack of sharply defined powder lines.

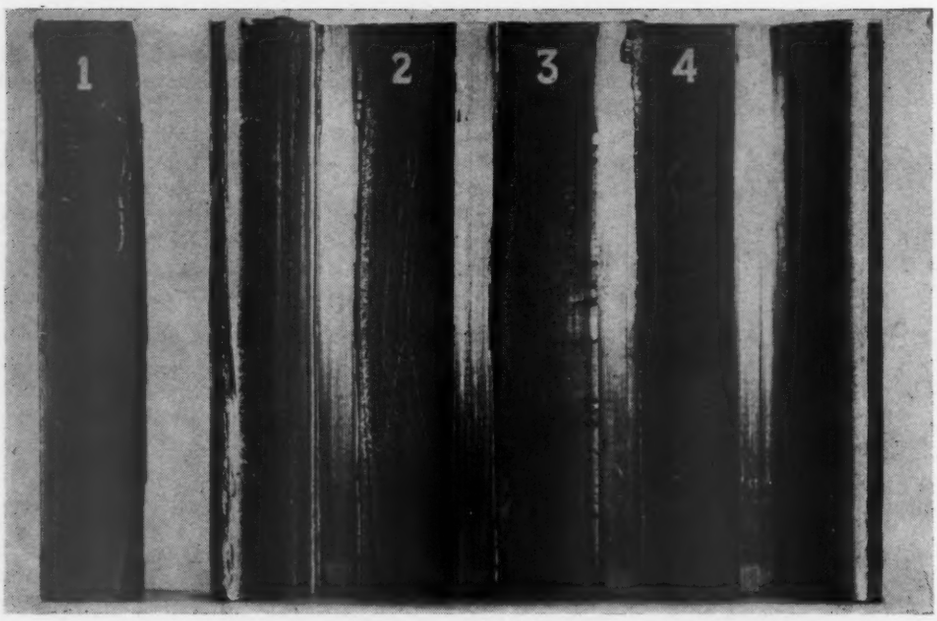
The importance of locating fatigue cracks cannot be too strongly emphasized as they contribute to hazardous and costly failures in service. Some fatigue cracks may be found in notches or blemishes resulting from numerous causes such as accidental bruising in handling, scratches, abrasions and nicks. Other fatigue cracks have their origin in sharp changes of section or contour, such as fillets, thread roots, oil holes, keyways and splines. Fatigue cracks may also be due to marks caused by grinding, grooves resulting from machining operations, file marks, sharp stencils, forging laps and manufacturing defects.

A careful book record must be maintained of all parts given Magnaflux inspection, indicating therein whether parts are clear or defective. This record should include location, date of inspection, description of part inspected including serial number and locomotive or car number if available, disposition of parts inspected and signature of inspector. When defects are found, their location, nature and extent with full descriptive detail or defect should be recorded.

When defects are discovered, the Magnaflux operator



Inside face of driving pinion showing worn condition of teeth and fracture on stub end of motor-armature shaft



Sections of failed traction-motor pinion showing: (1) fracture on broken tooth; (2) companion face of fracture on pinion; (3) adjacent fracture; (4) tooth broken out at laboratory

should notify the supervisor in charge who should arrange for proper disposition of defective parts.

E—Demagnetization after inspection can be accomplished either by passing the coil over the part inspected while current is flowing or by sinply reducing the current in gradual steps until the zero point is reached.

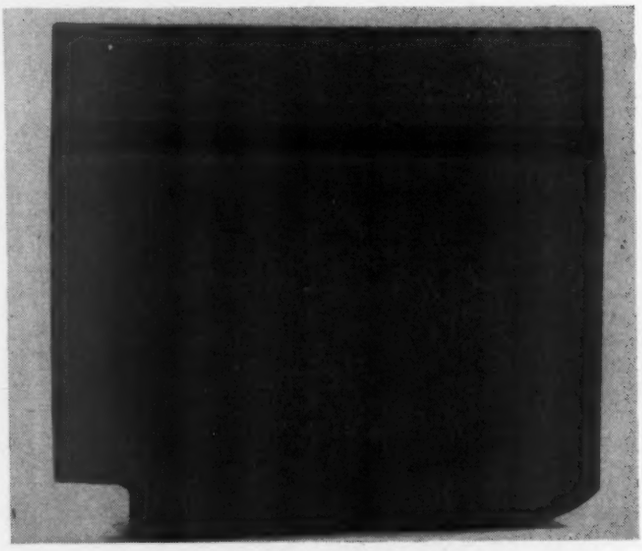
Instructions for Testing Diesel Locomotive Parts

Special instructions cover Magnaflux testing of the following parts of Diesel-electric locomotives.

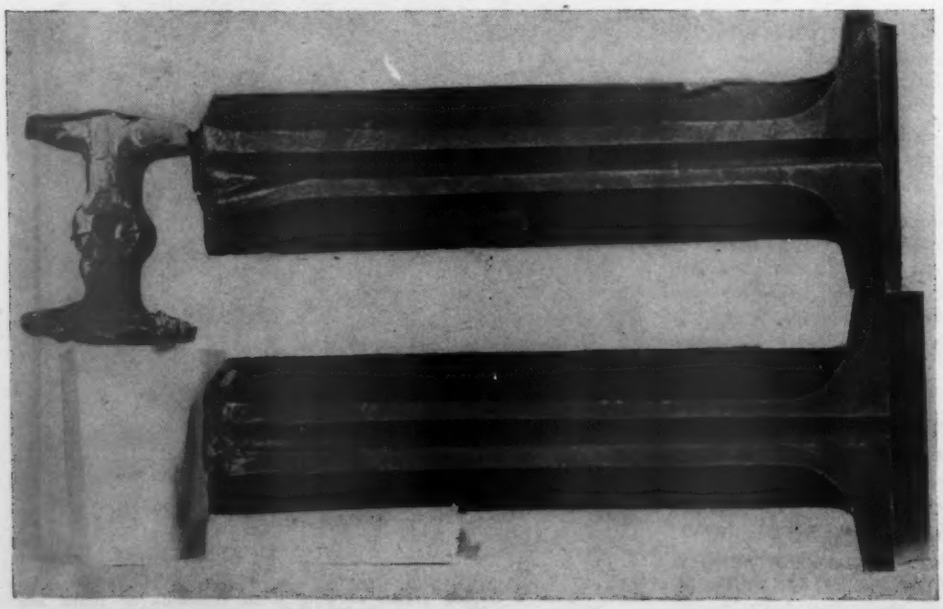
1—Axles of Diesel-electric road and switch locomotives, each time they are removed for any reason, must be Magnaflux tested and inspected on all exposed axle surfaces and axle gears for cracks and fractures.

2—When wheels are dismounted in addition to the above axle inspection, special attention must be given to wheel seats, motor support bearing journals. roller-bearing journals and fillets.

3—Axle and wheel assemblies removed on account of over-heating or questionable conditions must have roller bearings and motor-support bearings completely removed and the entire exposed surface of axle and axle gear given Magnaflux test and inspection.



Etched cross-section of failed pinion showing fatigue cracks at base of tooth



Broken sections of No. 1 connecting rod showing origin and extent of growing fractures

4—New axles taken from store stocks must be Magnaflux-tested and inspected after machining.

5—Pistons of Model 567 EMD Diesel switching locomotives must be Magnaflux-tested and inspected whenever pistons are removed for any cause.

6—New pistons applied to Model 567 engines in Diesel switching locomotives in 24-hour daily service must be removed and Magnaflux-tested and inspected at the end of 2½ years service.

7—Such pistons which are reapplied after 2½ years of service, must be removed every six months thereafter and Magnaflux-tested and inspected.

8—When motor support bearings on Diesel-electric road locomotives on arrival at maintenance terminals are detected to have abnormal temperatures or have overheated enroute, the entire wheel assembly must be removed from the truck and given a Magnaflux test and inspection over entire exposed surface of axle and axle gears.

9—Each time a traction motor is removed from the axle and wheel assembly for any cause, the pinion must be removed from the armature shaft and the pinion and exposed surface of armature shaft must be given a Magnaflux test and inspection for cracks, fractures and alignment.

During 1945 Diesel-electric road locomotive parts were inspected and Magnaflux-tested at Denver, Colo., and Omaha, Neb., shops as shown in the table.

In addition to the above parts listed the following other parts of Diesel-locomotives are Magnaflux-tested

Diesel Road Locomotive Parts Inspected in 1945

	Denver	Omaha	
Power axles	400	77	
Scrapped	3	0	
Defects ground out	3	0	
Ring gears	400	151	(includes switchers)
Scrapped	7	3	
Defects ground out	0	28	
	Denver	**Omaha**	
Pinions	400	62	
Scrapped	4	4	
Armature shafts	400	165	
Defective	3	35	

as these locomotives are shopped for classified repairs: truck frames, crank shafts, cam shafts, wrist pins, pistons, blower drive shafts, connecting rods, connecting rod caps and bolts, equalizers, bolsters, spring hangers, swing hangers, spring planks.

In order to take advantage of new developments in detecting fractures in non-ferrous Diesel-eiectric locomotive parts consideration was given to installing Zyglo and in January, 1946, the Union Pacific was granted the right and license to use the Zyglo method of flaw detection in six shops where Diesel electric and air conditioning equipment is being maintained.

Experience with Zyglo on the Union Pacific has been limited due to the installations being of recent origin. However, some demonstrations were made and restricted to Diesel valves, heads and pistons. A total of 142 valves were tested of which 18 were found defective due to cracked stems and seats. One defective piston and one cracked head was also found on these demonstrations.

A limited number of Zyglo tests ras been made on cylinder heads, valves, wrist pins, fan shafts, jack shafts, aluminum pistons and coupling pins.

Armature shafts, pinions and ring gear failures and most prevalent and constant inspection is required to keep road failures and delays to a minimum. A number of parts of Diesel-electric locomotives which were found on Magnaflux inspection and parts which have failed in service are shown in the illustrations.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Safe Ending Tubes and Flues

Q.—What are the limits for safe ending locomotive boiler tubes and flues? What are the condemning limits of tubes and flues? Does the length of service as specified by the Interstate Commerce Commission limit the life of a tube?—M. R.

A.—The limits for safe ending locomotive boiler tubes and flues vary on the different railroads. General rules which could be considered good practice are: (1) Tubes requiring safe ends more than 40 in. long, or having safe ends of a combined length of more than 40 in. or with more than three safe ends should be discontinued from service, and (2) Flues having safe ends of a combined length more than 50 in. or with more than two welds should be discontinued from service.

The condemning limit of tubes is usually determined by weight. This weight varies somewhat on the different railroads, the weight given below being an average. Tubes and flues are to be weighed and those meeting the weight shown in the following table are to be welded and used on any locomotive.

O. D.-In.	Nearest B.W.G.	B.W.G.-In.	Min. Wgt.-lb. per ft.
1¾	12	0.109	1.57
1¾	11	0.120	1.57
2	12	0.109	2.05
2	11	0.120	2.05
2¼	12	0.109	2.31
2¼	11	0.120	2.31
2½	12	0.109	2.56
2½	11	0.120	2.56
3¼	11	0.120	3.56
3¼	10	0.134	3.56
3½	12	0.109	3.66
3½	11	0.120	3.66
5⅜	9	0.148	7.51
5½	9	0.148	7.75

The I. C. C. Laws, Rules and Instructions for Inspecting and Testing of Steam Locomotives and Tenders and Their Appurtenances do not limit the life of a tube, except that they shall be safe and suitable for service. Rule 10 provides only for the periodical removal of the tubes and flues for inspection purposes.

Resistance Welding

Q.—What is resistance welding? Is it applicable to boiler work?—F. I. J.

A.—Resistance welding is a heat and squeeze process. The parts to be welded are raised to the temperature of fusion by the passage of a heavy electrical current through the junction. When the welding heat has been reached, pressure is applied mechanically to bring about the union. The field of resistance welding is in turn broken down into several processes, the most important of which are spot welding, butt welding, flash welding and seam welding. The spot weld is made by overlapping the parts and gripping the overlapped sections between two electrode points, through which the current is passed and pressure applied to make the weld in a single spot. Parts to be butt welded are placed end to end, heated electrically, and squeezed together. The flash weld is an adaptation of the

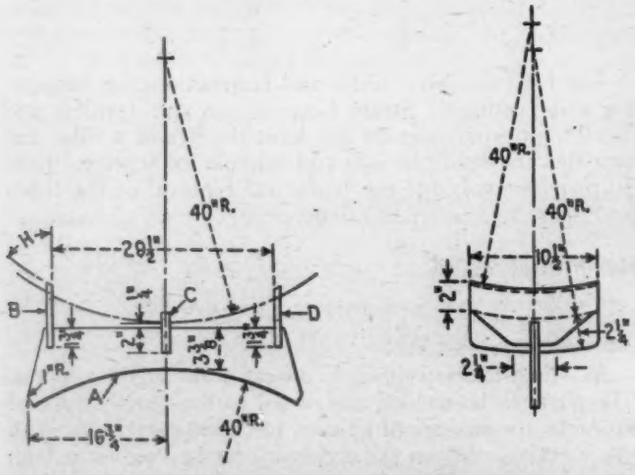
butt weld. The seam weld is similar to the spot weld except that a circular rolling electrode is used to produce the effect of a continuous seam. Resistance welding has a limited application in general manufacturing because special equipment is usually required for each individual welding job. It is therefore used chiefly for mass production. Resistance welding is not practical for boiler work, as its field is limited to light-gauge steels, such as those used in car work.

Wear Gauge For Chafing Plates

Smooth operation of steam locomotives and tenders around track curves is largely dependent upon the maintenance of correct standard dimensions and shape of the engine and tender chafing plates, which are rectangular steel castings, with a cylindrical bearing surface on the tender casting and a spherical surface on the locomotive casting. A floating block with similar curved surfaces, only in reverse, "floats" between the two chafing plates and this design assures easy swiveling on curves and also allows necessary vertical motion between the engine and tender frames.

In order to provide for the maintenance of correct bearing surfaces on chafing plates, a special gauge is used on the Texas & Pacific. The particular gauge shown in the illustrations is for T. P. Class M-1 and M-2 locomotives. Gauges of the same design but with different detail dimensions are supplied for use with other locomotive classes.

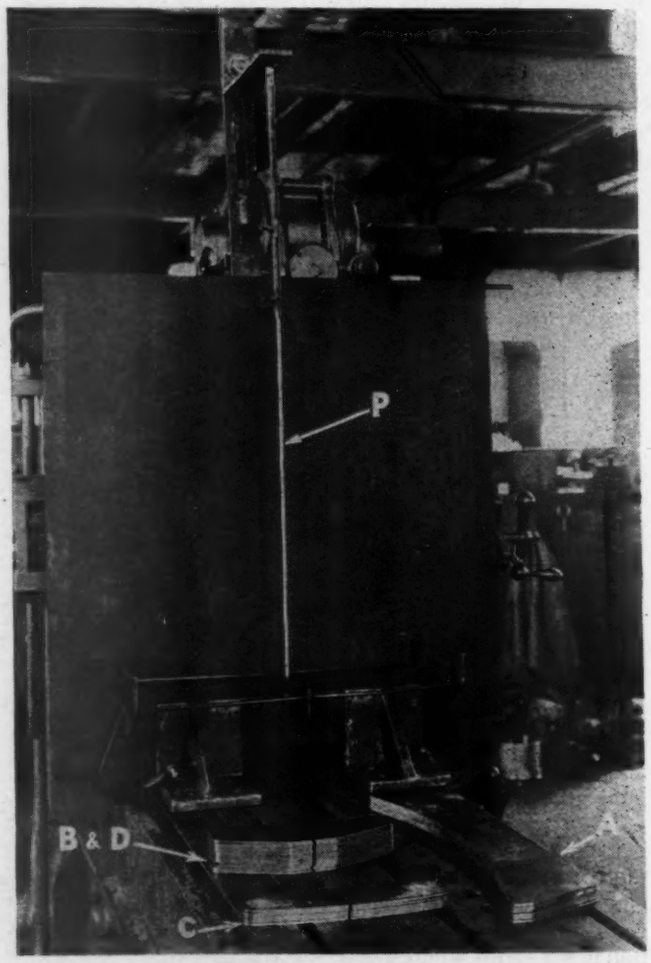
Referring to the drawing, the construction of the chafing-plate gauge will be apparent. It is made of ⅛-in. steel plate and consists of a center plate *A* and three cross plates *B, C* and *D* which are slotted to fit over the center plate and spot welded to hold them in the correct position. Center plate *A* is machined to a 40-in. radius on the lower edge which is used for gauging the face of the cylindrical tender chafing plate longitudinally, the limit of wear being ⅛ in. This same single-plate gauge could, of course, be used to check the 40-in.-radius spherical surface on the locomotive chafing plate, if the gauge were applied in several different angular positions and always in line with the center of the sphere. A slight carelessness in this respect, however, would obviously lead to incorrect reading and possibly serve to pass chafing plates with wear in excess of the prescribed ⅛-in. limit.



Gauge developed on the Texas & Pacific for measuring chafing-plate wear on Class M-1 and M-2 locomotives—Dimensions vary for other classes of power

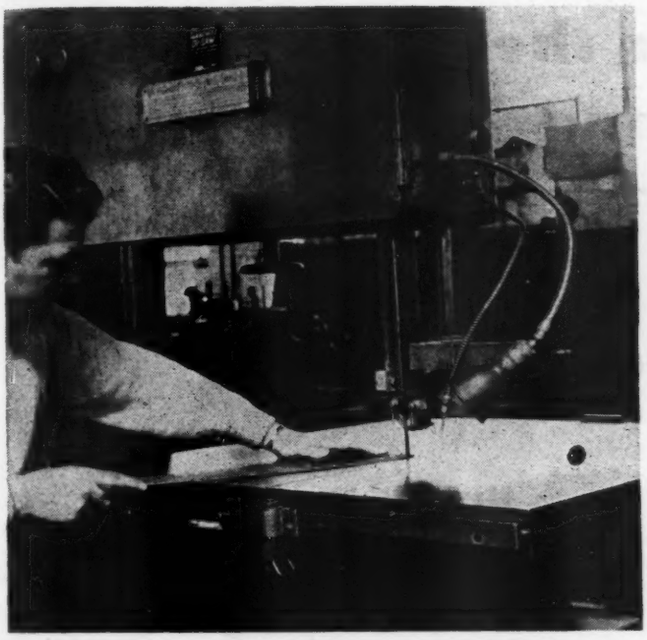
To avoid this possibility, the gauge is equipped with cross plates *B, C* and *D*, machined to fit accurately the surface of a sphere of 40-in. radius. When this part of the gauge is applied to the locomotive chafing plate, therefore, any slight mis-alinement of the gauge will make no difference and the amount of wear on the chafing plate will be accurately indicated by a single application of the gauge.

The general procedure in constructing these gauges is to make a number of them at one time. Individual plates are laid out and roughed out on a Tannewitz metal-cutting band saw, shown in one of the illustrations, leaving ⅛-in. stock for finish-machining in stacks on a milling machine. Since plates *B* and *D* are identical, only three different-shape plates are required for each size of gauge. One detail which should not be overlooked is that the curved edge of plates *B* and *D* must be chamfered to angle *H*.



Adjustable radius pointer used in setting gauge cross plates before tack welding them permanently in position

In assembling, the gauge plates are taken to the bed of a small planer which is equipped with a bracket extending high enough above the machine bed to permit suspending a long adjustable pointer *P* from a ball-and-socket connection on the upper cross bracket. With this pointer adjusted to a 40-in. length, for example, one of the *A* plates is clamped to two angle brackets, as illustrated; two end plates *B* and *D*, also one center plate *C*, are applied with individual slots fitting closely over plate *A*; all three cross plates are adjusted in height until their upper curved edges just contact the pointer throughout the complete



Roughing out the gauge plates on a Tannewitz metal-cutting band saw

arc; and these plates are then tack-welded securely in place.

The result is a lightweight, accurate gauge which may be used with confidence that any wear in either the locomotive or tender chafing plates will be clearly shown.

Air Brake Questions and Answers

The 24-RL Brake Equipment for Diesel-Electric Locomotives*

429—*Q.—In what type of service can this brake be used?* A.—Any kind of service, including high-speed passenger and road freight service.

430—*Q.—To what type of locomotives is this brake applicable?* A.—Steam or Diesel-Electric.

431—*Q.—What design does this brake equipment follow?* A.—The same general principles employed in predecessor locomotives.

432—*Q.—How does this equipment compare with older equipment insofar as its functioning?* A.—The design of this equipment provides all of the functions in an equal or improved manner, with the feature of being permitted to limit the equipment to those functions required by the service in which the locomotive operates.

A and B Units of the Diesel-Electric Freight

433—*Q.—What are the desirable features included in this equipment?* A.—Self-lapping independent brake valve; controlled full-release with manual change-over; automatic power cut-off in emergency and manually controlled sanding.

434—*Q.—How does the control of locomotive brakes compare with that of the former designs?* A.—As in former designs the locomotive brake may be used with or independently of the train brakes. The locomotive brakes may be applied with any desired pressure between minimum and maximum and pressure automatically maintained in locomotive brake cylinders regardless of leakage or variation in piston travel. The locomotive brake can be graduated on or off with either the automatic or independent brake valves.

435—*Q.—What is the advantage in having these features?* A.—In all kinds of service the train may be handled without shock or danger of parting.

436—*Q.—What feature has the automatic brake valve in full release?* A.—A controlled full release with provision for easy manual change-over to main reservoir full release at any time by means of a cut-out cock on the brake valve.

437—*Q.—Describe the controlled full release position.* A.—In this position (extreme left position of the brake valve handle) a new large capacity feed valve provides a high rate of flow to the brake pipe at feed valve pressures.

438—*Q.—What is the advantage of this feature?* A.—It provides the same reliability of release previously obtained, without the liability of overcharge.

439—*Q.—How is main reservoir full release obtained?* A.—By cutting in cut-out cock, recharging the brake pipe as heretofore.

440—*Q.—What precaution is taken to avoid misuse?* A.—A warning port operates in the release position to inform the engineman of the brake valve handle position.

441—*Q.—What medium is used to bring about a uniform application on both a time and pressure basis?* A.—This is accomplished through the medium of displacement volume, which delays the beginning of effective brake cylinder pressure development on the locomotive to coincide with that on the cars, after which both train and locomotive cylinder pressures build up uniformly.

442—*Q.—What features are embodied in the emergency position?* A.—Emergency applications are adjustable to provide slack control according to the service. This feature provides a rapid development of locomotive brake cylinder pressure for passenger and short freight trains; or a controlled build-up for long freight trains.

443—*Q.—What control is available for brake pipe service reduction?* A.—The automatic brake valve has a first service position for use of long trains with maximum permissible leakage.

444—*Q.—What does this position provide?* A.—An initial normal service rate of brake pipe reduction sufficient to initiate quick service on the train brakes, after which a slower rate is imposed, allowing the brake pipe pressure to readjust itself throughout the train and avoiding a heavy reduction at the front end.

445—*Q.—What assurance have we that this imposed rate is not exceeded?* A.—A maintaining type of equalizing piston is employed.

446—*Q.—What is gained by the use of this position?* A.—The engineman is able to gather the slack gently by using this position, avoiding a heavy head end brake application and resultant hard run-in of slack.

447—*Q.—In the event of a safety control application, what feature is provided for service application?* A.—A valve called the K-2 Rotair valve, which will be described later, is turned to position marked *P*, thus providing for an automatic full service straightaway application. In long trains, the Rotair valve is turned to position *F* to permit automatic split-reduction full service application.

448—*Q.—What is the advantage of an automatic split reduction?* A.—It makes smoother stops initiated from the safety control feature.

449—*Q.—In case the safety control handle or foot pedal is inadvertently released momentarily what can be done?* A.—A delay feature permits the engineman to prevent a safety control application, if the foot pedal or automatic brake valve handle are immediately depressed when the safety control whistle sounds an alarm.

* This is the first of a new series of questions and answers relating to the No. 24-RL brake. References are to Instruction Pamphlet No. 5066.—Editor.

With the Car Foremen and Inspectors

Handling

Freight-Car Wheel Changes

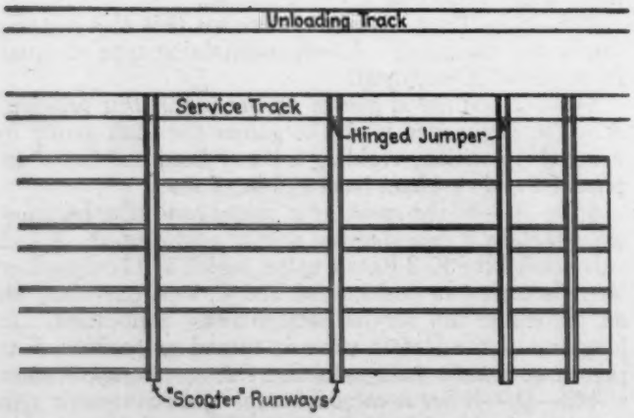
By P. P. Barthelemy*

Part I

A scheme of storage tracks described which reduces wheel movement, and the amount of manual handling — Needed facilities simple, mostly shopmade

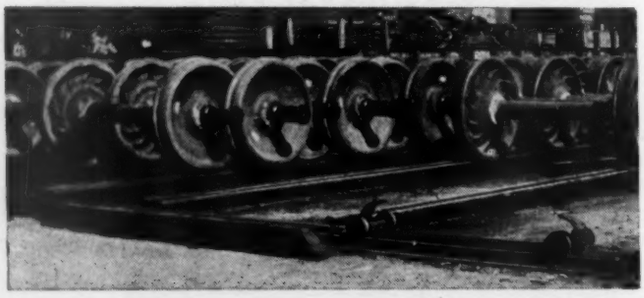
ONE of the headaches on a great many repair tracks is lack of adequate facilities and equipment for handling freight-car wheel changes. This is particularly true at the smaller repair points, manned by "forgotten men". Yet in many instances changing wheels is one of their major duties. Some of the larger repair points are not much better situated. True, a great many modern installations have been made, but only a small percentage of the million or so annual wheel changes are handled there. Some modernization has been done at other points, but for one reason or another too much of the wheel work, including local handling, is still being done the hard way, out-of-doors in all kinds of weather at that. Desirable improvements are constantly being suggested, but too frequently they are not carried out. Yet there are few places where a greater return on the investment may be realized than by improving rip tracks, particularly wheel-handling facilities.

If conditions are such that the entire arrangement cannot be revamped, there are items that can be currently changed and improved to make present facilities more efficient. For example, there are all kinds of rip track layouts, including wheel storage and handling facilities, some of which "just grew"; but since we are here concerned with wheel changing, our remarks are confined to items affecting that work. Wheel storage necessarily requires a relatively large area of ground, and too frequently the location selected or available seems to have been an after-thought; yet conveniences for wheel handling are of major importance to any repair track layout. It may be impractical to change the wheel storage location, in which event such rearrangement as can be made to improve facilities should be given consideration.



Mounted wheel storage to minimum labor in handling

There are a few fundamentals: Handling must be reduced to a minimum; new wheels must be grouped as to axle sizes, as must also second hand; and rotation of stock without extra handling is desirable. There must be space for the lesser kinds of wheels carried, such as one-wear and other types of steel wheels, which can best be carried on short storage tracks, separately to avoid extra handling. There must also be ample space for the temporary storage of the bad-order wheels.



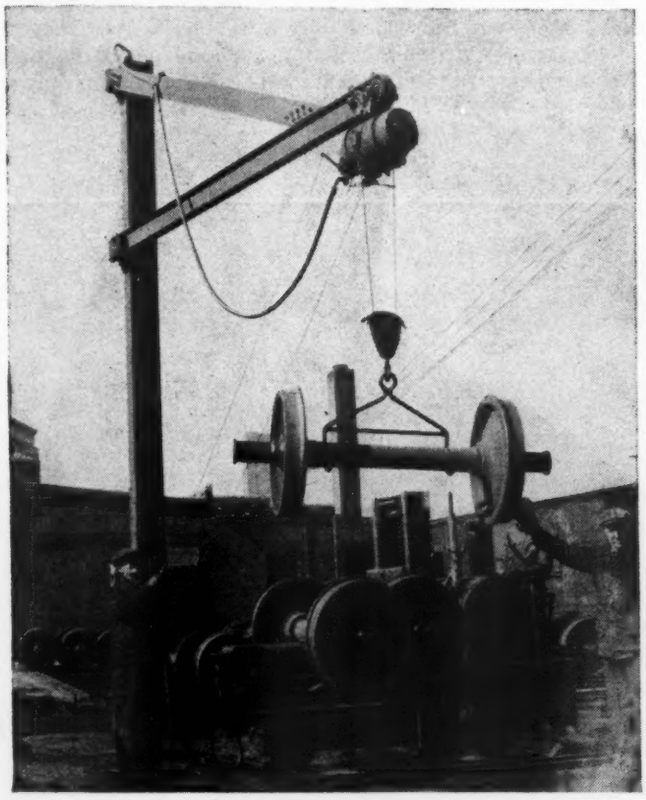
Wheel-storage tracks and scooter transfer dolly

The drawing illustrates a basic plan for wheel storage, by means of which handling is reduced to a minimum. The size and shape of this can be changed to suit the plot of ground available, still retaining the basic features of the plan. Fundamentally, it consists of a series of storage tracks laid parallel to the service or unloading track, separated into panels by narrow transfer tracks on which a scooter dolly is operated. These transfer tracks may be made of old pipe, Petler rail, etc., laid on a timber or heavy plank base, or old 10-in. or 12-in. channels may be used as rails. Wheels as received are rolled or placed on the dolly, which is then run to the appropriate storage track, upon which the wheels are rolled. Wheels are removed from the storage track in a similar manner. The wheel-support brackets on the dolly are of proper height so that no

* Recently retired master car builder, Great Northern.

lifting of the wheel is necessary. The several panels separated by these dolly-transfer runways permit a layout that may be adapted to most of the present storage plots. The dolly wheels should be equipped with roller bearings, which if necessary may be made from ordinary steel rods.

As to storage tracks, excepting at the larger points few concrete platforms are found. Aside from the use of old



Wide-swing gib crane and air-operated hoist used in handling mounted car wheels

rails, good storage tracks may be made of light Petler rails with both rails of the twin track laid longitudinally on a wide timber or heavy plank base. Only occasional gage spacers are required. Where old rail is used, only a few ties per rail length are needed, and the projecting ends of the ties should be short so as not to obstruct the passage between tracks. Six-inch channels laid flat with flanges turned upward make good storage tracks. In all cases, the spacing of twin rails should be 6-in. to meet A. A. R. recommendations.

The outer rail of the service track is continuous; on the inner rail, hinged-gap-filler or jumper-bars are used so that wheels may be rolled past as necessary. The manner in which wheels are handled from storage to the car, at the car, then back to bad-order storage is of course largely dependent on facilities available, which vary widely.

Changing Car Wheels

In considering wheel changing, the starting point is the manner in which wheels are handled from storage to the are shipped in, loaded on ordinary flat cars, on special wheel cars fitted with guiding rails, or on wheel cars fitted with slot recesses for receiving the wheels; in each case, are the wheels loaded single or double deck?

Where wheels are received in considerable quantity, a substantial long-arm gib crane with a good electric or air hoist is best. This should have a stiff mast set in a concrete base, in order to avoid the use of obstructing guys, and should have as wide a swing as possible. Such a crane is shown in one of the illustrations. The arrangement should include means for moving the car as may be necessary in the progress of both unloading and loading operations.

For the smaller points receiving wheels loaded single deck, a small and convenient gib crane may be cheaply installed. Such cranes, electric or air operated, have rendered satisfactory service. The most advantageous location for the wheel crane is directly adjacent to the storage tracks, though it may be located a little more distant, provided the service track extends to the hoist.

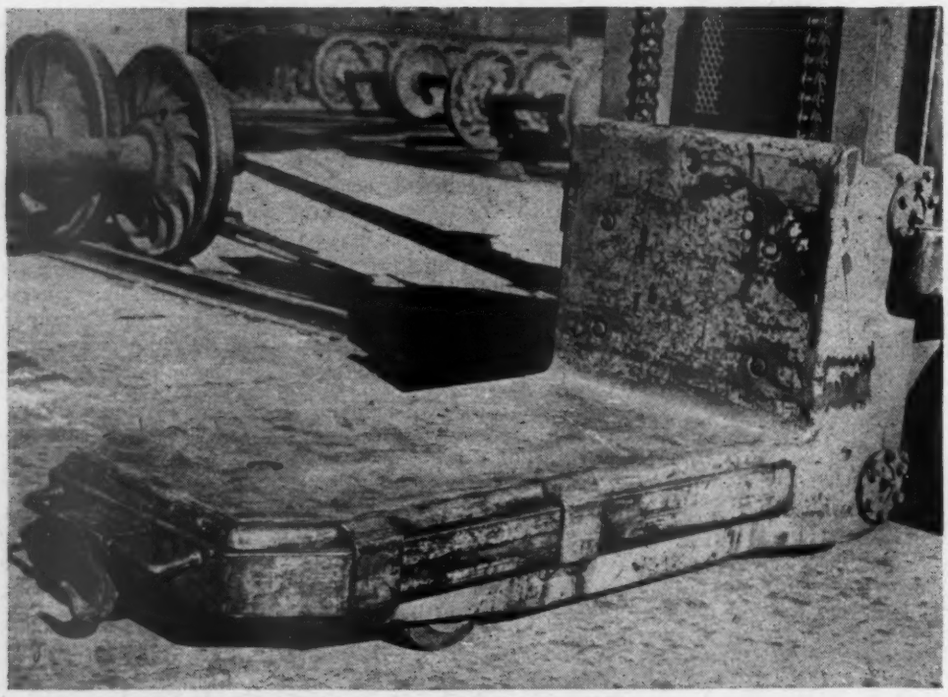
For handling the wheels a rigid forked hook device is handy. Forked cables with clamps to engage the wheel rims are also extensively used. Needless to say, no handling device contacting the journals is to be tolerated.

Good runways and platforms are important and must be given serious consideration. Concrete is of course the preferable material for these, since it requires no upkeep, is permanent, and provides a much higher degree of safety than those of wooden construction, though the latter are much better than none at all. Runways should be wide enough to permit free passing of trucks and tractors. Full coverage makes a nice layout but is not always practicable. Some still have a preference

Yale lift truck with bracket extended for handling mounted car wheels

for the standard-gage service tracks, and there is much to be said in their favor. These may be readily retained with concrete runways by imbedding the rails in the concrete with their top surface flush with the runway and with minimum width and depth flange trenches. In that way the rails offer no obstruction to the operation of trucks and tractors; this is also applicable to wooden runways. At a great many rip tracks, rolling the wheels is still the cheapest and most rapid transportation.

Some form of permanent base along the repair track rails is essential for the safe and quick placement of jacks. Planking, at least, is desirable between the rails, particularly for outside work.



Lift truck with wheel-handling bracket retracted to avoid interference with other loads

Where conditions are such as to admit of their use, tractors, particularly the lift-platform type, are advantageous for transporting wheels, since two or three pairs can be handled in one load, and if fitted with a sliding bracket, as shown in one of the illustrations, the wheels may be easily placed in position on the rails at the car and the bad-order wheels similarly removed. Details of the sliding-bracket arrangement are seen in another view which shows that the bracket does not hamper the use of the tractor for other heavy service.

Rebrassing and repacking of boxes is part of wheel-changing work and the successful performance of the wheels applied is dependent on proper workmanship. Quite a large portion of the rip-track wheel changes are made on account of cut journals, and much of that under loads, so that if the complete job is not properly done boxes are likely to run hot and wheels will again have to be changed at the next repair point. Proper care of journals has already been mentioned. Great care must be exercised in the removal and application of boxes and side frames to avoid scratching the journals. Any bruising of the bearing surface must be avoided. The broaching of bearings to obtain a closer fit on journals is being done on some roads and is an excellent practice. Worn-out wedges should be thrown out. Box packing in general is being well done. Waste and oil should be of the highest quality obtainable for the purpose, as in the final analysis they are the cheapest. When packing-retaining devices are used, be careful in their removal and application to avoid bending.

An item frequently slighted in connection with mounted wheel storage and handling is the selection of the best possible journal protection-coating compound. Such a compound to be effective must not be impaired by rain or snow, must be insoluble in water, should set in a few hours' time, and when set must present a surface to which cinders and grit will not stick. Finally, it must be of such a composition that it can easily be removed by means of a sponge or wad of waste dipped in kerosene or distillate—materials commonly available.

Specially-prepared petrolatum compounds meeting these requirements are on the market; these require only a thin coat to be effective. The use of coatings that are difficult to remove is to be avoided, as are also materials that remain sticky, since cinders and grit lodge in the soft sticky surface and scratching of the journal occurs when the compound is removed. The time expended on the removal of some types of journal compounds together with the injury to the journal polish by that removal, as well as rusting that occurs if the compound is not effective, are very important matters. Also, since a good compound is best applied in a thin coat, the cost of coverage is lower than for cheaper types requiring heavier coatings.

A closely fitting sheet-metal sleeve for protecting journals

In the care of journals, a good fundamental rule is to

prohibit the use of any substance or device more abrasive than the palm of a clean hand contacting the journal surface. And do not let those journals get rusty, not even in the smallest spots!

For special wheels likely to remain in storage for long periods of time, a close-fitting metal sleeve, such as shown in one of the views, is a good protective device, the journals of course to be thoroughly grease-coated.

(Part II will appear in the July issue.)

Safety Appliances*

By G. P. Lindahl†

When referring to safety appliance rules we must bear in mind that they are for the safety of employees as well as the public and any violation is apt to cause personal injuries, wrecks and all kinds of trouble.

It is a mistake to feel that one safety appliance law is more or less important than another. There is no question that every rule was put in the book for some good reason and was given considerable thought and discussion before being written.

In the last year, we have heard as much about running boards as any other appliance, so this is a good place to start. Until a few years ago, running boards were, as a whole, all wood, but now certain metal running boards are acceptable. I have had a few reports of metal running boards being broken close to the ends of cars. This should be watched.

Running Boards

The rules state that wooden running boards should be securely fastened by screws or bolts. Do not use nails, and when applying screws remember the hammer is not a screw driver and should not be used on screws. With heavier running boards now being applied, don't forget that longer screws are necessary to properly secure the running boards. In checking safety appliance rules, you will note the end of longitudinal running boards shall not be less than 6 in. nor more than 10 in. from a vertical plane parallel with the end of the car passing through the inside face of the knuckle when closed with the coupler horn against the buffer block or end sill. When inspecting a car, do not become alarmed if you see one on which running boards look way short before you make sure of the type of underframe. If it has a Duryea underframe, an allowance of an additional 8 in. on an ordinary car is allowed and 11½ in. on a caboose.

The proper inspection of wood running boards is not an easy matter. We all know that a car with a loose, missing, decayed or broken running board should be bad ordered, but just where to draw the line in some cases is a matter of good judgment on the part of the car inspector. I believe any of us that have gone over cars inspecting running boards have sometimes debated if a car should be set out or not. Many times, it is a case of judgment to set out a car or let it go. Personally, I do not believe a man should jump on a running board to try to break it, or to use a pry to see if it is loose.

After the car has been set out for a defective running board, the question of repairing then comes into the picture. To begin tearing off and replacing a running board complete is entirely wrong many times, when the condition is such that this is not necessary. This causes a waste of material and labor and car delays, but at the same time good judgment must be used to see that short patches are not used and such minor repairs made that the car will have to be set out again for running board defects within a short time. I believe the inspection and repair of running boards, more than any other appliance, calls for the good judgment of inspectors and repairmen.

Hand Brakes

The hand brake is one thing that has gone through a lot of changes in location, as well as types. It is now ordered that on or before January 1, 1949, all cars used in freight service must have power hand brakes. The law at present calls for any efficient design, but must provide the same degree of safety as the design shown on Plate A of the U. S. Safety Appliance book. This is the shaft with at least a 15-in. diameter handbrake wheel on top. There must be at least 4 in. of clearance all around the wheel and the outside edge of the wheel must not be less than 4 in. from a parallel plane passing through the inside face of the knuckle when closed and the coupler horn against the buffer block or end sill. In regard to this clearance, the car inspectors must be alert to watch for gondola cars with ends bulged out.

The rules are clear that the brake shaft must not be welded. This is a violation and the reason is that no one can tell when a weld will fail. When inspecting hand brakes, one thing to check is to make sure the brake shaft cannot be lifted up so that the pawl will not engage the ratchet wheel. The most common defect is bent or broken shafts or handbrake wheels, defective pawl and ratchet wheels. The rules sum it all up by saying brakes must be efficient and work in harmony with the power brake. When you come to power hand brakes, some are still overlooking welding rules or are in a hurry to get out rush loads and will do some prohibited welding. Remember the welding rule reads, "Welding of cracks or fractures in operating parts of power hand brakes or building up of the horizontal shaft is prohibited."

On the old style shaft, some inspectors are overlooking rules for freight cars which state ". . . not less than ½-in. hex. or square-head bolt must be used to secure hand brake chain to shaft drum." This does not mean carriage bolts.

When testing any kind of a hand brake both inspectors and repairmen are apt to give it a little spin and call it O. K., instead of really testing it. This leads to cars coming back to repair tracks for defects that should have been found on the first trip. It can cause personal injury and extra switching.

In regard to hand brakes on passenger cars: The rules state they shall be efficient and operate in harmony with power brakes thereon, and shall be located so they can be safely operated while the car is in motion.

The main reason I. C. C. Inspectors many times take exception to hand brakes on passenger cars, claiming they are not efficient, is that various levers or rods foul so the brakes cannot be set tight. One of the most common defects called to my attention is that the brake pawl cannot be moved due to rust and dirt.

Sill Steps, Ladders and Handholds

Sill steps on cars have set rules for size and application, and once properly applied the most common defects are bent, broken or loose. As a rule, there is no question if a sill step is defective or not.

On wood sill cars, especially refrigerator cars, always be on the lookout for badly-rusted bolts, as they can easily be overlooked, but can cause personal injury. For instance, a heavy man getting on a moving car puts considerable strain on a sill step.

* Excerpts from a paper presented at the April 1 meeting of the Northwest Carmen's Association, St. Paul, Minn.

† General car inspector of the Northern Pacific.

Ladders and handholds, like sill steps, should be checked for application and have about the same general defects as a sill step. The matter of handhold clearances is confused by some. As a rule, we talk 2½-in. clearance. Some inspectors overlook that on freight cars the rule states, ". . . minimum 2 in., preferable 2½ in. . . ." This means what it says. In other words, do not set out a car for handhold or ladder clearance if it has 2 in. clearance. When inspecting passenger cars, men regularly assigned to freight cars overlook some handholds. On passenger cars the law says, ". . . not less than 1¼ in., preferable 1½ in. clearance." It is better to check the rules for clearances, as on many other handholds on passenger cars the rule states, ". . . not less than 2 in., preferable 2½ in. . . ."

The rule states that for application of handholds on freight cars at least ½ in. bolts or rivets must be used. When bolts are used, when it is possible, the nuts must be on the outside. Some of the repairmen overlook instructions that nuts must be on the outside when possible, and put nuts on the inside, which is a reportable defect. Some inspectors also will set out cars when nuts are on the inside, when it is impossible to put them outside.

Remember, the law does not permit welding handholds to a car, and when inspecting passenger cars if you do not check the application rules you may get fooled, as some handholds can be secured with bolts, rivets or screws, and note there is no size specified.

When repairing metal side ladder stiles, remember it is permissible to repair by patching.

The handhold that comes in for trouble a great many times is the roof handhold. This is, as a rule, secured to a latitudinal running board and, if defective, a man going over the top of a car cannot see it until he takes hold of it and if it fails it means a bad fall. Do not overlook that, when carmen are making repairs to a roof handhold, an air brake repairman is apt to want to get on the car in testing the retainer valve, so do something to call his attention to work being done on the roof handholds.

The rule requiring the bottom treads of side ladders and the end ladders to have a foot guard near the inside ends with stiles of ladders projecting 2 in. or more from the face of the car to serve as foot guard is often overlooked by both repairmen and inspectors.

We have all noticed an additional grab iron on new cars and overhauled cars, this on the left end of car. This was adopted as a standard by the Mechanical Division of the American Railway Association in 1932. It must be maintained the same as other appliances.

When handholds are bolted, the law is plain that bolt ends must be riveted over. If you apply a lock nut, the bolt must still be riveted over. The same rule applies to various other bolts used in securing safety appliances. The most common failure to comply with this rule is when replacing sill steps or handholds to the underside of tank-car running boards when making repairs.

Uncoupling Lever and Couplers

The main thing about the uncoupling lever is that it can be of any efficient design and can be either single or double. The inspector, when inspecting it, should be in the habit of taking hold of the handle to see that it works properly and is not defective. By taking hold of the handle and pulling a little, you will know if it is disconnected or the lock lifter is fouled. On the old style uncoupling lever, shown on Plate B of the Safety Appliance book, the length of handles and center lift arms comes in for question a great many times. The minimum drop of the handle is 12 in., maximum 15 in. over all. The center-lift arm is 7 in. minimum length to eye center.

The law requires coupler heights on standard gauge railroad freight cars, measured from the level of the top of rails to the center of the drawbar, to have a maximum height of 34½ in., minimum height 31½ in. Knuckles cannot slip over as long as they are within the prescribed limits of height. One has to watch out for couplers with drooping downward heads which may cause a break-in-two at any time and especially so when there are several inches of slack in addition to normal travel due to gear compression. The Safety Appliance book shows that more than 1½ in. free slack in the draft gear is classed as a safety appliance defect. When applying shims under the coupler to take the droop out of heads, the type prescribed by the A. A. R. should be used if possible. Shim, Fig. 4, A. A. R. Rule 20, is used. That is the one that has a lip bent on one end and two bolts used to hold it in place at the other end. When you apply this shim, be sure to apply it so that bolts will be on the inside of the carrier iron, or slide towards the center of the car. If applied the other way, when the coupler comes back, in time it will shear the bolts and the shim will drop out.

Air Brake Inspection

One of the important things is inspection of air brakes and air tests. In going over the I. C. C. report for the fiscal year ending June 30, 1945, it looks good to see the number of outgoing trains inspected by I. C. C. inspectors and found to have 100 per cent air and most others to have 99 per cent air, and inbound trains to have 97 to 100 per cent air. It is important, in order to maintain and improve on this, that all inbound cars be given a good inspection and see that brakes are made O. K. If this is done there is little chance of not being O. K. when departing. To get 100 per cent, first it is important that all valves are properly repaired and tested in the air brake room and when cars are on the repair tracks that they are properly tested and checked. When adjusting brakes on repair tracks, whenever possible, repairmen should leave all holes possible in dead lever guides for take up in the yard when necessary. Over 10 in. piston travel is considered excessive and is a defect.

A question that comes up every once in a while is, if the law prohibits the movement of a non-air car in a train. The answer is "no," but it must have an efficient hand brake, air train line and other safety appliance appurtenances as required by the U. S. Safety Appliance rules.

Familiarity with requirements of the law, so carmen will know what to do, takes a lot of study and reviewing of the rules. One good way is to discuss rules among yourselves. At one point on the Northern Pacific last year one of the foremen held a class on A. A. R. rules one evening each week. He had a fair attendance for a small force which is employed at that point, and there is no question it did a lot of good and it did bring out the A. A. R. books. Some time ago, I was talking to a foreman of another line who posts one question each week on A. A. R. Rules and one on safety appliances. No answers are posted. This stimulates interest and gets older employees to review the rules.

New Jib Crane Helps in Car Shop

One piece of equipment, which has been installed a little over a year in the wheel-and-axle shop of the St. Louis Southwestern at Pine Bluff, Ark., and effected economies primarily in the handling of car axles, is shown in an illustration with the main steel freight-car shop in the

background. This is a self-supporting pillar-type jib crane with full-circle swing for the 19-ft. boom which is elevated 14 ft. above the shop floor and designed to support a 2,000-lb. load at the end of the boom.

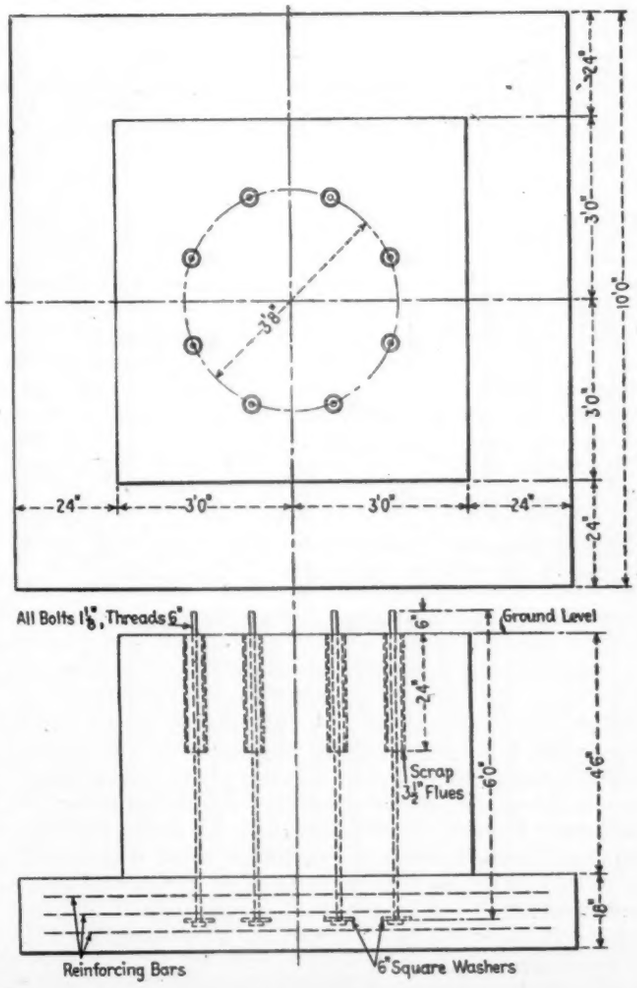
The mast is made of 16-in. seamless pipe, weighing 75 lb. per ft. It is welded to a 4-ft. circular base-plate and braced by eight triangular gusset plates welded in place and equally spaced around the base of the mast. The boom consists of a 15-in. I-beam with a 12-in. channel on top, securely bolted at the mast end to a steel hood which carries a substantial thrust-bearing unit for contact with the top of the mast and two widely spaced roller-bearing units within the hood.

The boom is equipped with a Shepherd-Niles 2,000-lb. electric hoist, complete with ball-bearing plain trolley and operated by a 2½-hp., 440-volt, 3-phase, 60-cycle electric motor with pendant single-speed push-button control. The maximum lift with the motor and cable is 18 ft., and the hoisting speed is 30 ft. per min.

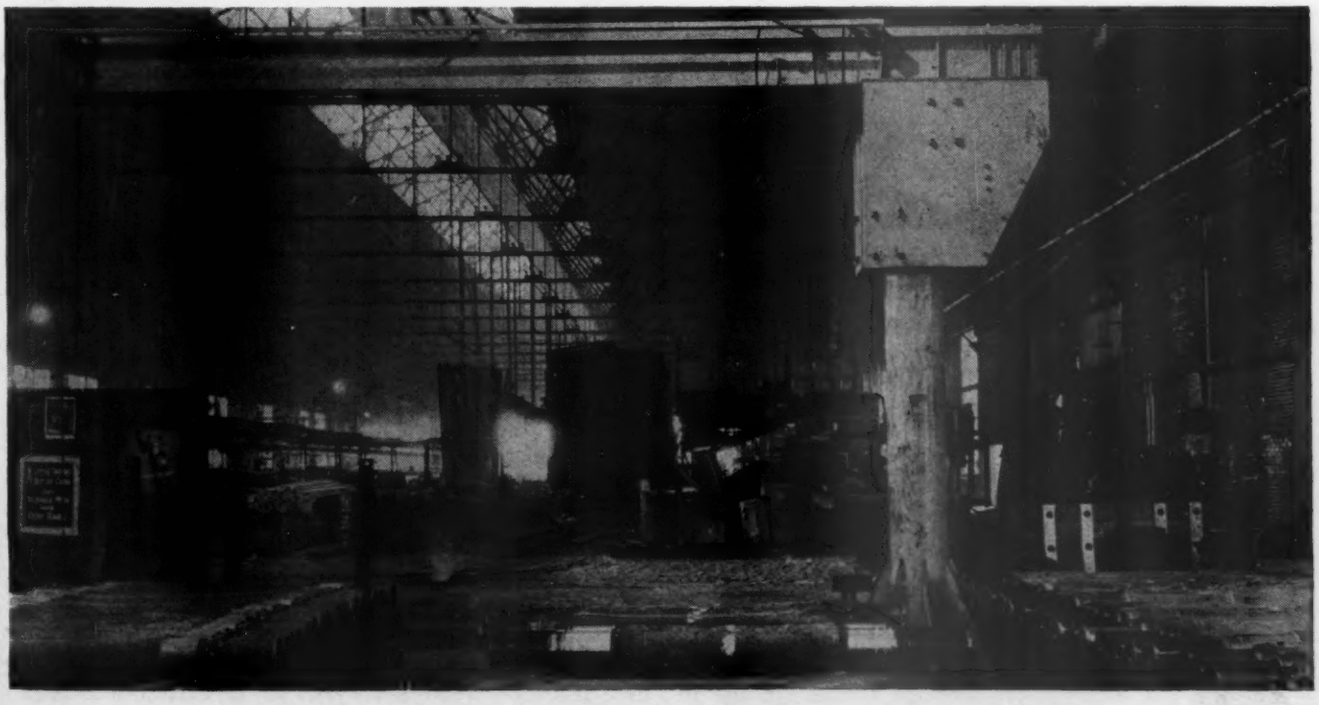
Electric power is supplied to a small square box at the base of the crane and carried up through a conduit inside the mast to a three-ring pick-up conductor in the mast hood, and thence to a three-phase No. 4 copper-wire conductor which extends the length of the boom and is kept taut by strain insulators.

An important feature of this jib crane is, of course, the method of mounting the mast so it will be rigid and hold the boom accurately level in all positions and under maximum loads. Reference to the drawing will show the size and shape of the concrete foundation used to support the crane. The main bed pad, 18 in. thick by 10 ft. square, is located 6 ft. below the surface of the shop floor and reinforced with steel bars. Poured at the same time as the bed pad is a smaller 6-ft. square section of concrete extending upward to floor level and forming a solid support for the jib crane. Eight 1⅛-in. bolts with 6-in. square washers under the heads are anchored in the bed pan and extend up through the foundation and 3½-in. by 24-in. scrap flue sections, set in the top as illustrated.

The use of these flue sections frees the upper ends of the anchor bolts and permits adjusting them for slight misalignment when the crane base plate is set in place. Once the base plate is in position, the space around the foundation bolts is filled with grout, nuts are applied and tightened; and the crane mast is permanently and accurately held in the desired vertical position.



The jib crane foundation



Full-circle-swing jib crane installed in the Pine Bluff freight-car shop of the Cotton Belt

ELECTRICAL SECTION

Electrical Service on Wheels

Mobile equipment for electrical maintenance and construction developed by the Chesapeake & Ohio

THE Chesapeake & Ohio's specially equipped highway trucks and construction cars for electrical work have proved to be an effective means for disposing of a growing problem common to all railroads.

The use of electrical power for the operation of the railway's facilities located at outlying points, such as wayside pumping plants, coaling stations, turntables, etc., has rapidly increased during past years and has reached a stage where only a very small percentage of such facilities use other forms of power. Electric lighting of depots and various wayside buildings has also increased in equal, if not greater proportion. Practically all of the wayside pumping plants are automatically operated and unattended, except for periodic visits of maintenance men.

District Maintenance Electricians

These circumstances have led to the necessity of establishing a set-up whereby these facilities could be properly inspected and maintained. In 1938 a force of traveling electricians known as District Maintenance Electricians was organized, this force consisting of five electricians, each assigned to certain territorial limits designated as Districts. In laying out the districts, the limits were determined by the amount of equipment to be maintained, its accessibility from headquarters' point and certain other considerations. Only one district is confined to one operating division, the other four taking in portions of two or more divisions.

The primary duties of the district electricians are to inspect and maintain motors and other electrical equipment in the electrically operated wayside pumping plants and other facilities at outlying points. They make regular monthly inspection tours over their territory, visiting each point where inspections are to be made. After each inspection, they fill out a standard inspection sheet and mail it to the electrical engineer. Along with the inspections they perform such work as is found necessary to maintain the equipment, and they also perform considerable other electrical work within the physical capabilities of one man, such as repairs to lights and wiring in depots and various other buildings, small wiring installations, repairs to power lines, etc. These men also respond to emergency calls in case of failures at pumping plants, etc.

At first, the district electricians were required to cover their territory by train, which necessarily involved some lost time in waiting for trains, etc. Due to curtailment of local train service, particularly on branch lines, and further increase in electrical facilities to be taken care of, it became desirable to provide automobile trucks for the district electricians to enable them to cover their territory in less time, to respond to emergency calls more quickly, and to handle a greater volume of work.

During 1941, five half-ton panel body automobile trucks were purchased, and one assigned to each of the district electricians. These trucks are used regularly in making inspection tours, and are often used in responding to emergency calls and in handling other work when train service will not suffice. The average annual mileage is approximately 20,000 per truck. The electricians carry in these trucks at all times the tools, repair parts and materials ordinarily needed in their regular maintenance work, and they also carry such special tools and materials as may be required in the performance of other work that is to be done while they are on the road. The trucks are also used in certain cases for the quick transportation to and from the shops of failed motors and other apparatus requiring heavy repairs.

Headquarters and territory of the five districts are as follows:

	Headquarters and home station	Territory
District No. 1 ...	Richmond, Va.	Richmond Division and Clifton Forge Division east of Clifton Forge.
District No. 2 ...	Hinton, W. Va.	Clifton Forge Division west of Clifton Forge and Hinton Division.
District No. 3 ...	Huntington, W. Va.	Huntington Division.
District No. 4 ...	Ashland, Ky.	Ashland Division, Cincinnati Division (excluding Cincinnati Northern Sub-Division) and Chicago Division.
District No. 5 ...	Columbus, Ohio	Hocking Division and Cincinnati Northern Sub-Division.

The district electricians are carried on the payrolls of the master mechanics of the divisions in which headquarters' points are located. Their activities in general are directed by a road electrical foreman, who is a member of the electrical engineers' organization at Richmond, Va. Routine inspection and maintenance work is covered by standing instructions, and instructions concerning other classes of work are handled by correspondence, or by telephone and telegraph if of emergency nature.

In some emergency cases and in some local matters, instructions are given the electrician by the master mechanic, and there is also an arrangement whereby the electrician may, in emergency, be contacted by the division superintendent, division engineer, or water supply supervisor, if conditions warrant.

Reports furnished by the district electricians include a daily time report, a daily report on mileage and use of truck, and a semi-monthly progress report covering all work except regular inspection and maintenance. The time and truck reports are sent to the master mechanic, who later furnishes this data to the Richmond office. The

progress report is sent direct to the Richmond office, and serves to eliminate much answering of correspondence on the part of the electricians. Location schedules are sent to the Richmond office and to the master mechanic. These are made up and mailed on Saturday to cover the activities of the coming week. If interfered with by emergency calls or for other reason, corrections are made by telegraph or telephone. The railroad reserves the right to work district electricians in territory other than that regularly assigned to them when emergency or special occasion may require.

This organization has functioned very satisfactorily, but it has been found essential that the jobs be filled by well trained and competent men.

System Maintenance Electricians

When the force of district maintenance electricians was organized, it was realized that they would from time to time encounter jobs on which they would need assistance; that there would be absences due to illness or other cause; and that there would be times when the volume of extra work would exceed their capacities. To take care of these conditions, the organization included one system maintenance electrician who works at any point on the system where he may be needed, exclusive of the larger shops where local electricians are employed. To facilitate the movement of the heavier tools, such as are required for setting poles, and of certain materials, a single camp car was assigned to the system maintenance electrician. This car is moved from point to point over the system as required, and is equipped with sleeping quarters, space for storage of tools and materials, and work shop facilities.

Another function of the system maintenance electrician, in conjunction with district electricians, is to provide temporary air-conditioning standby and battery charging facilities for special or extra cars and trains, which sometimes lie over at outlying points where there are no regular standby or charging facilities. To provide for this class of work, the camp car assigned to the system maintenance electrician is stocked with a sufficient number of standby cables, charging cables, wire, connection boxes, etc.

The activities of the system maintenance electrician are directed by the road electrical foreman, and he is carried on the payroll of the master mechanic at Huntington, W. Va., which point is also his headquarters and home station. The system maintenance electrician sleeps on the camp car, except when the car is in transit, or when engaged in work at points where it is impractical to move the car. On occasion, in emergencies, and when the size and volume of work requires, it is necessary to provide a helper or another electrician to work temporarily with the system maintenance electrician.

Construction Force

In addition to the above-mentioned electrical forces, the railroad operates a system force known as the electrical construction force. The full complement of this force is one foreman, nine electricians, one helper and one cook. They are housed in camp cars containing suitable living quarters, kitchen, dining and office space, tool and material storage space, and work shop facilities. They perform heavy electrical maintenance and construction work that is beyond the physical capabilities of the district and system maintenance electricians, and the local electrical forces at the various shops. Much of their work consists of pole and power line reconstruction; however, they also handle a great many construction projects, such as pole and power line installation, installation of transformers and substations, large motors, air-conditioning standby and battery charging systems, interior wiring, floodlights, and other heavy electrical work, exclusive of that on rolling stock.

This force does not perform all of the heavy electrical work on the system. In the construction of new buildings and certain other structures, the usual practice is to have all work in or on the structures done by contract and to install the outside power supply lines, etc., with railroad forces. There are also certain jobs, such as the rewiring of large buildings, that can be handled more economically and satisfactorily by the railroad force, because of elimination of the extensive and detailed plans and specifications required to perform by contract.

When assistance is needed by the system maintenance electrician, an electrician or helper is sent out from this force. The activities of the electrical construction force are also directed by the road electrical foreman and their time is carried on a special payroll which is handled through the electrical engineer's office.

Construction Equipment

There are four cars used by the electrical construction force. These include a tool and material car, a bunk car, a cook car, and a car fitted for transportation of an automobile truck. The tool and material car is a baggage car with sliding side doors. Pipe tools carried in the car include pipe dies, a Tom Thumb portable pipe threading machine for pipe up to 3 in. and bolts to and including ¾ in., a portable hydraulic pipe bender for conduit up to 4 in., pipe vises and a pipe pushing jack for pushing pipe under platforms or roadways. There is a conduit rack under one of the work benches. Pressure for the pipe pusher is supplied by a hand-operated oil pump. The pipe pushing jack can handle pipe up to 3 in., and can push up to at least 30 ft. in ordinary soil.

For welding, the car is equipped with a 200-amp. portable electric welding set and oxy-acetylene equipment for both cutting and welding. The welding set is fitted with a double-throw switch so that the motor may be operated from either 220- or 440-volt, 3-phase power.

Other tools on the car include a ¾-in. electric drill, a ⅝-in. portable electric drill, a ¼-in. portable electric drill, and a double-wheel motor-driven grinder. The ¾-in. drill has a stand in the car which makes a drill press. A 2,000-watt, 110-volt d.c. Kohler lighting plant supplies power for lighting when an outside power connection is not available. The drills and pipe threader have universal motors and can be operated from the lighting plant, but the nature of electricians' work is such that it is usually done where power is available.

This car is also equipped with a complete set of line work tools, including pike poles, dead men, block and tackle, wire pulling clamps, digging tools, cant hooks, reel jacks for cable reels, a pole jack for pulling poles, insulating blankets, rubber gloves, clamps and jumpers for line work, a hoist for pulling guys, blow torches, etc. There is also an assortment of fish tapes, hand tools, safety belts, climbing irons, etc.

The bunk car contains bunks and lockers for ten men. The lockers are large enough to accommodate traveling bags and all-weather clothes. There are washroom facilities and a shower bath, the car being equipped with overhead tanks. There is also an electric water cooler. In the cook car there is a dining room, a kitchen, and storage space for supplies and utensils. There is also office space and sleeping accommodations for the foreman and for the cook. Refrigeration was supplied by the crew, which repaired a damaged unit.

A ¾-ton pick-up type automobile truck is assigned to this force for the transportation of men and materials to and from the scene of work in situations where the camp

(Continued on page 320)

Diesels To Replace Electrics

Satisfactory operation of Diesel locomotives on Boston & Maine's Fitchburg Division which includes the 5-mile Hoosac Tunnel, with its recently improved ventilation, makes it possible to eliminate the electrification through the tunnel

NEED for the Boston & Maine's electrified section has apparently been eliminated by the use of Diesel-electric locomotives on all its through traffic on the Fitchburg division. The recent improved ventilation of the Hoosac tunnel makes the operation of Diesel locomotives through the tunnel zone entirely satisfactory.

The electrification was completed in May, 1911, from North Adams, Mass., through the Hoosac tunnel, to the Hoosac tunnel station, a distance of 7.92 miles. The tunnel is on the railroad's main line, Fitchburg Division, which runs from Boston, Mass., to the west, out of the Connecticut River Valley, into that of the Hudson River, through the Berkshire Hills in the northwestern corner of Massachusetts. The divide is crossed by the five-mile Hoosac tunnel, a two-track bore, with a grade of approximately 0.5 per cent, ascending from each portal to a summit within the tunnel.

There are 7.92 miles of double track between the terminals of the electrified section. Yard tracks electrified bring the total to 21.38 miles. Rolling stock consists of seven electric locomotives, five of which were placed in service in 1911, and two in 1917. These locomotives, supplied by the Westinghouse Electric & Manufacturing Company, are 11,000-volt, a.c. units, having a 1-BB-1 wheel arrangement. The first five units each weigh approximately 261,800 lb., while those delivered in 1917 weigh 265,500 lb. They have a continuous rating of 1,224 hp. Tractive force is 18,480 lb. at 27.6 m.p.h.

The reasons given for the electrification in 1911 were "increased capacity and elimination of smoke in tunnel." With steam locomotives, operation was extremely difficult in the tunnel, even after oil was substituted for coal. With electric operation, due to the short length of the electrified line, steam locomotives are not detached from either freight or passenger trains. The electric locomotives are equipped with multiple-unit control, and one or more are attached ahead of the steam locomotive, the number varying with the weight of the train. The Diesel-electric locomotives now in service are made up of 1,350-hp. units, supplied by the Electro-Motive Corporation, two or four units being used on a train.

Tunnel Ventilation

To provide for Diesel operation through the tunnel, the railroad has installed two large, electrically operated propeller fans in a new fan house. Features of the installation are the large size and type of fans, and an electrical system employing remote control and automatic protection. The new fans, replacing the old inefficient ventilating fan, were installed to secure larger blower capacity and thereby improve the air, moisture and general operating conditions through the tunnel.

One of the Diesel-powered trains which now operate through the tunnel without need of an electric locomotive

The Hoosac Tunnel

The Hoosac tunnel, which was completed in 1875, is 25,081 ft., or nearly five miles long, and is tangent throughout, directly under Florida Mountain, and pointed almost due east and west. The old fan, which was installed nearly 50 years ago, was located in a fan house at the top of the mountain, about seven miles from North Adams, Mass., and has been used both to suck air out or to blow fresh air down into the tunnel through a central 15-ft. by 27-ft. vertical ventilating shaft, 1,028 ft. deep, driven when the tunnel was constructed. This fan was of the paddle-wheel type, 15 ft. in diameter and 8 ft. long, with axial air inlets at both sides. It had a theoretical capacity of 250,000 cu. ft. per min., and was powered by a single 2,300-volt, 3-phase, 60-cycle motor.

In later years, the actual capacity of the old fan was much less than the rated capacity. In addition, it became unreliable in operation and badly corroded, in spite of the fact that it had been rebuilt with wrought-iron vanes twice in the last 10 years. Accordingly, it was planned to replace this fan with two modern fans, housed in a new single-story building. The use of two fan units, instead of one, was planned so that one fan could be shut down for repairs, if necessary, without interfering seriously with tunnel ventilation, and the installation was made without taking the old fan out of service until the new equipment was ready for operation.

The new ventilating equipment was considered necessary even though almost all freight trains now operating through the tunnel are pulled by Diesel locomotives, and although it is expected the Fitchburg division, which includes the tunnel, will soon be completely converted to Diesel operation. In fact, the accumulation of Diesel exhaust gases under heavy traffic is such that, without ventilation, severely noxious conditions would result.

New Installation

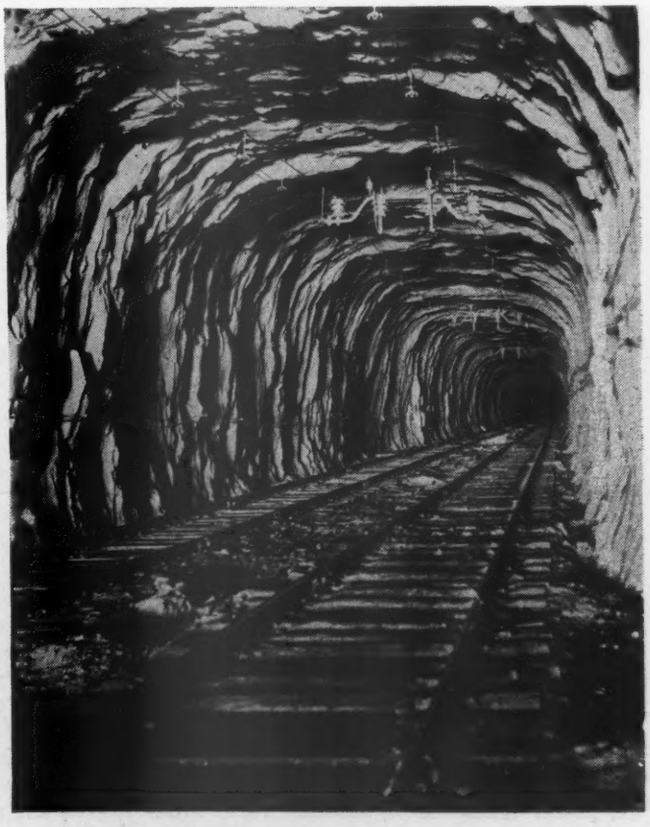
The new fan house, like the old, covers the top of the tunnel ventilating shaft, but extends toward the south from the shaft, whereas the old fan house extended toward the north. The new house is of brick and concrete construction and is approximately 47 ft. by 52 ft. in plan. Its rear or north wall, which is convex, semi-elliptical in shape, extends around the edge of the ventilating shaft. The interior of the fan house is partitioned by two curved brick walls to form a plenum chamber through the center, from north to south, extending from the ventilating shaft to the fans, which are located at the southeast and southwest corners of the building, and blow toward the south. The space betwen the plenum chamber walls and the outer walls on the east and west sides of the building is utilized for separate motor rooms for each fan. A control room, 16 ft. by 20 ft., projects from the building on the west side at the north end of the west motor room.

Propeller-Type Fans

The new fans are 90-in., Jeffrey Type-8H Aerodyne mine fans, each with a capacity of approximately 260,000 cu. ft. per min. Each fan has 8 plastic blades with adjustable pitch, by means of which they can be set at 7 different angles for most economical operation without overloading the motors. The fans are located in large tapered metal exhaust tubes, which vary from 8 to 15 ft. in diameter and extend 35 ft. beyond the south wall of the fan house. The end of each exhaust tube is covered by a double door, hinged in the middle, which opens when the fan is in operation. If only one fan is being operated, suction closes the doors of the fan not in operation, so, in effect, the doors operate automatically. Each fan propellor is mounted on a horizontal shaft supported on roller bearings and is driven at either 390 or 590 r. p. m. by a 100-hp., Westinghouse, dual-speed induction type motor with roller bearings, which operates on 440-volt, 3-phase, 60-cycle alternating current. The motors are located in the two motor rooms and the long drive shafts connected to the fans extend through two walls. Each shaft is supported between the motor and fan by roller bearings mounted on steel pedestals.

The motor bearings are grease lubricated, while the fans and shaft bearings have oil lubrication, which is piped to the bearings from an oilette located in an external

An early picture of electrified operation taken shortly after the electrification was completed



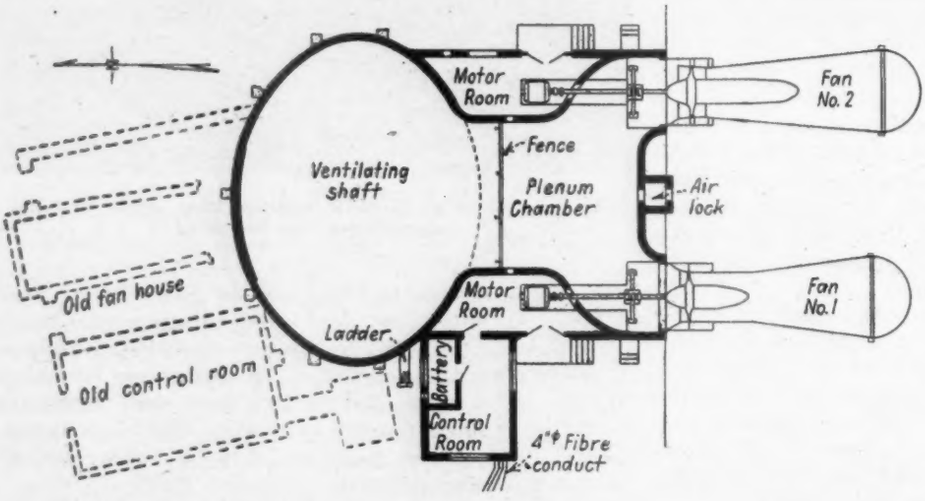
Looking into the eastern end of the Hoosac tunnel

cabinet. With this system of lubrication, it is necessary to replenish oil and grease only about once a month.

A 6,600-volt, 3-phase transmission line from North Adams supplies power for the tunnel facilities. Three 75-kva., 6,600/480-volt transformers serve the motor circuits, and a 10-kva., 6,600/120-240-volt transformer supplies lighting and control circuits. The main service and starting switches are located in the fan house control room.

Unlike the old fan, the new fans are used only to suck air out of the tunnel. They are normally operated on the basis of visibility and moisture in the tunnel, as reported to a signal tower at North Adams by locomotive enginemen, track walkers or other railroad workmen. The fans are controlled electrically and can be operated either singly

The ventilating equipment as it now appears above the center of the tunnel



Plan of new fan house showing also location of old ventilating facilities

or together at either low or high speed, but never with one fan operating at high speed and the other at low speed. The approximate capacities of the various operating combinations are as follows:

1 fan at low speed, 165,000 cu. ft.
1 fan at high speed, 260,000 cu. ft.
2 fans at low speed, 310,000 cu. ft.
2 fans at high speed, 475,000 cu. ft.

These capacities vary somewhat with atmospheric and operating conditions, such as the way the wind is blowing, the direction of train movements, etc. For example, two trains approaching the center of the tunnel simultaneously tend greatly to accelerate the exhaust of air up the shaft. Under average conditions, both fans can completely exhaust the air from the tunnel in 25 min.

Remote Control

The fans are normally operated by remote control from Spragues Tower, a newly constructed signal tower at North Adams. Push buttons and a carrier-current system are used, with the control desk at the tower located upstairs in the operator's room. One room in the lower story of this tower, known as the control room, is devoted entirely to the fan control equipment. This room contains a 125-volt storage battery and a 48-volt storage battery. A third storage battery for supervisory control is located in the control room of the fan house on top of the mountain. Push button controls are also provided in the fan house control room and in each of the two motor rooms.

Safety controls, actuated by thermal relays, automatically stop either fan in case of hot bearings, in which case a buzzer indication at the signal tower control desk shows which bearing is hot. There is an oil circuit-breaker in the power transmission line at North Adams, remotely controlled from the signal tower, and the transformers on top of the mountain also have thermal relays which automatically shut off the power to the transformer in case of trouble and give an alarm indication at the tower.

Electrical Service on Wheels

(*Continued from page 317*)

cars cannot be placed nearby or where the work consists of several jobs widely separated, as is often the case in a large terminal area. The quick means of transportation afforded by this truck has resulted in handling assigned work with maximum speed and efficiency. Where conditions are favorable the truck is also useful for various other purposes, such as pulling heavy cables, erecting poles, etc.

When the force moves from one location to another the truck is loaded in a car fitted for this purpose and shipped along with the other cars assigned to the force. This car is a box car fitted with double-end doors of sufficient size to permit entry of the truck. Suitable channel steel loading skids and specially designed anchoring equipment for the truck are carried in the car. The truck occupies one end of the car, and the other end is used for storage and transportation of heavy wire, cables and miscellaneous materials. Arrangement of the skids, etc., is such as to permit the truck to be driven into and out of the car under its own power.

Work is always available for the construction force. It is normally scheduled well in advance, each job being done in the order of its importance, with due regard for minimizing the movement of the cars.

A. C. Power for Passenger Cars

Power generated at 110 volts d.c. is converted to 220-volt, 3-phase a.c., 60-cycle power for motors with 3-wire, 110/220 single-phase power for lights

THE Norfolk & Western has developed a power system for passenger cars which will deliver regulated 220-volt, three-phase, 60-cycle a.c. power to all motors on the car, and will supply 220/110-volt power for lighting. The system was worked out in the railroad's shops at Roanoke, Va., and one installation like that shown in the single-line diagram will be applied to a Norfolk & Western car.

Power is generated by an axle-driven 110-volt, d.c. generator operated in conjunction with an 88-cell Edison storage battery. The d.c. power is converted to three-phase, 60-cycle, a.c. power normally at 67 volts by an inverted rotary convertor.

Regulation of the speed of the rotary convertor is obtained by use of a carbon-pile generator regulator so connected that the action is reversed as compared with its application to an axle generator. As the battery voltage rises, the regulator strengthens the field of the rotary proportionately, maintaining nearly constant speed and frequency. The starter is a two-step, d.c. resistance starter.

The output of the rotary is applied to the primary of a three-phase, self-regulating transformer which raises the 67 volts to 220. Approximately constant output voltage is obtained by means of capacitors and reactors in the transformer. Tests show that a 30 per cent variation of voltage on the primary will cause a variation of only 4 per cent on the secondary.

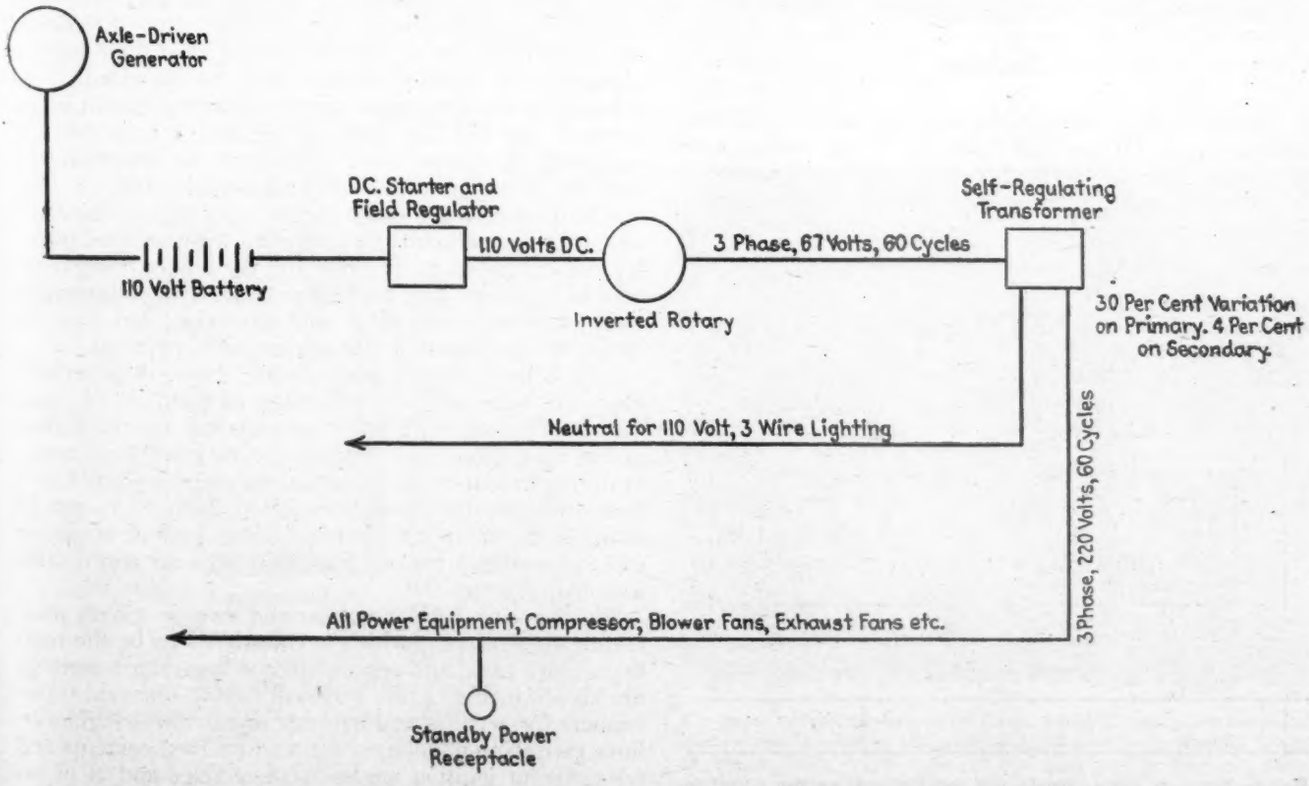
Power for lighting is obtained by using center or neutral taps on the transformer secondary from one, two, or three of the phases and is distributed by three-wire 220/110-volt circuits. This permits the use of standard fluorescent or incandescent lamps with a minimum size of wire.

Standby power will be plugged in directly to the a.c. end of the power system, a connection in the receptacle serving to operate a relay which will automatically open the circuit between the rotary and the transformer. The rating of the generator is 20 kw., the battery is 300 amp. hr., the rotary is 12 kw. and the transformer 12 kva.

This arrangement of apparatus, as operated in the shop, has proved its effectiveness for application to cars. It will, however, be modified for additional applications.

The self-regulating transformer is a relatively expensive piece of equipment, and, in future designs, the inverted rotary convertor and the transformer will be replaced by an Amplidyne inverted convertor which in itself will have an output of 60-cycle, three-phase power at 220 volts. It will be self-regulating, have approximately constant frequency and constant output voltage throughout the d.c. voltage range of the battery. Operating conditions on the Norfolk & Western aided by the efficiency of the 110-volt power system make standby battery charging unnecessary.

This proposed a.c. system will permit the use of commercial compressors for cooling and other refrigeration with hermetically-sealed compressor motors.


Axle-Driven Generator
DC. Starter and Field Regulator
Self-Regulating Transformer
110 Volts DC.
3 Phase, 67 Volts, 60 Cycles
110 Volt Battery
Inverted Rotary
30 Per Cent Variation on Primary. 4 Per Cent on Secondary.
Neutral for 110 Volt, 3 Wire Lighting
3 Phase, 220 Volts, 60 Cycles
All Power Equipment, Compressor, Blower Fans, Exhaust Fans etc.
Standby Power Receptacle

Single-line wiring diagram for the 110-volt d.c./220-volt, three-phase, 60-cycle a.c. car power supply system

Rectifiers for Railways

3,000-volt sealed Ignitrons have been developed which will function both as rectifiers and inverters permitting regeneration without rotating machinery

HIGH-voltage ignitron rectifiers and inverters for railroad service are described in a paper which was presented at the North Eastern District meeting of the American Institute of Electrical Engineers, held at Buffalo, N. Y., on April 24-26, 1946, by J. L. Boyer and C. G. Hagensick, design engineers, Westinghouse Electric Corporation, of which the following is an abstract.

Single-anode pumped-type mercury arc rectifier tubes have been established in the 300-, 600- and 900-volt field in the past few years, and as a result they have become the most important type of equipment for large power conversion at these voltages. The ignitron was the major development which brought about the change from multi-anode to single anode tubes in this low-voltage field. Recently, sealed ignitrons have been developed for very high voltages and lower currents. This paper describes high-voltage pumped ignitrons which have been made available for power conversion in the 3,000- to 4,000-volt range.

The major application for mercury-arc rectifiers in this voltage range is for railroad service. Therefore, the requirements for railroad loading have been given special consideration in the design of the high-voltage ignitron. Both rectifier and inverter characteristics were desired in one unit so that a maximum of flexibility including regeneration could be obtained.

The paper describes characteristics of combined rectifier and inverter operation. Accepted fundamental rectifier and inverter relationships are presented, and the design and tests which led to the successful development of high-voltage pumped ignitrons are discussed. The relative merits of pumped and sealed ignitrons are also discussed. The following excerpts are parts of the paper which deal specifically with railroad applications.

Ratings

Typical ratings required for rectifier units for railroad loading are 2,000 kw. and 3,000 kw. These ratings were used as a basis for the design of the 3,000-volt ignitrons.

Railroad loading usually requires very heavy overload ratings. Ignitron rectifiers are especially suited for suddenly applied overloads, because they show no tendency to cause arc surges at any reasonable water temperature and because their arc-back performance is less dependent on previous loading.

The proposed A.I.E.E. heavy-duty rating which is used in the testing of high-voltage rectifiers for railroad service is the following:

100 per cent rated load continuously
150 per cent current for 2 hours, following 100 per cent load
300 per cent current for 5 minutes, following 100 per cent load

With low-voltage, high-current ignitrons it is found that the inverter rating of a given design is lower than the rectifier rating. In high-voltage rectifier operation, the required design results in improved inverter performance.

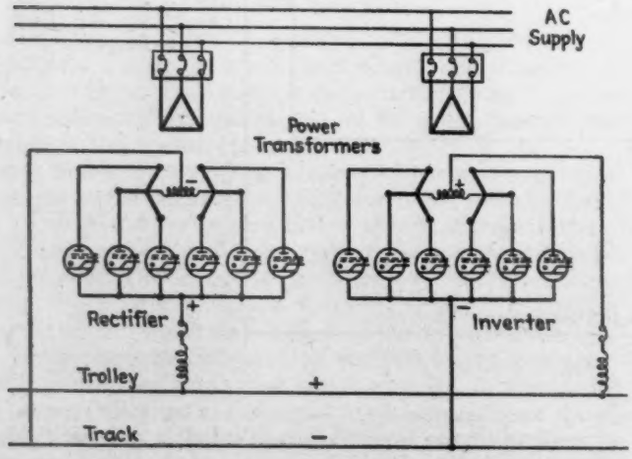


Fig. 1—Delta, six phase, double wye rectifier and inverter circuit for railway substation

Regeneration

One of the important requirements for a railroad substation in mountainous country is regeneration. This can be accomplished by mercury-arc rectifiers in a number of different ways.

(1) A given unit may be operated first as a rectifier when power is required and then as an inverter when regeneration is required. A reversing switch to change the polarity of the power circuit and means for rapidly changing the ignition angles must be provided. This scheme has the advantage that duplicate equipment is not required but has the disadvantage that a time delay is necessary to change from rectification to inversion and that the reversing switch has considerable duty.

(2) Two or more units may be operated on the same bus, with one permanently connected with reversed polarity and excited as an inverter and the others being operated as rectifiers. This method provides a smooth changeover between rectification and inversion, but has the disadvantage that duplicate equipment is required.

(3) Where heavy overloads and heavy regenerative loads are expected, a combination of methods (1) and (2) can be used. Both units can carry the overloads, and as the load drops, one unit can be switched over to inverter operation to carry normal regenerative loads. If a heavy regenerative load is required, both units can be changed to operate as inverters. This type of operation makes possible a smooth transition between rectification and inversion.

Fig. 1 gives a typical rectifier and inverter circuit illustrating method (2), which is considered to be the most important. Load and regenerative voltage characteristics are shown in Fig. 2, for a system having identical transformers for rectifier and inverter units. These regulation lines give the d.c. voltages for various load currents and for different ignition angles A of rectifier and B of inverter. The slope of these lines is determined mainly by

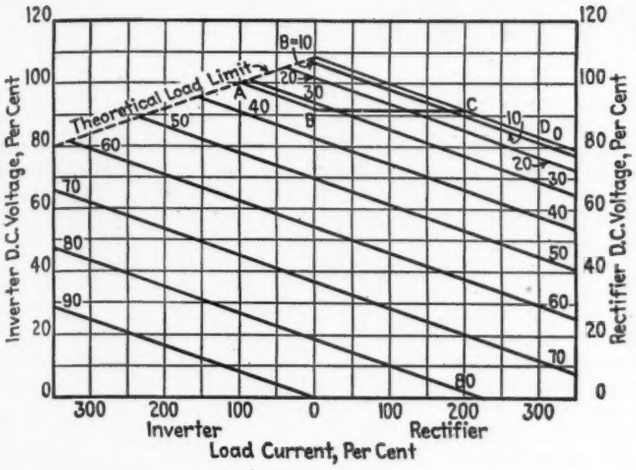


Fig. 2—Regulation curves of rectifier and inverter, 8 per cent regulation and same transformer secondary voltages

the transformer reactance, and the values at zero current are proportional to the cosines of the ignition angles.

Circuit Characteristics

In normal operation the action of any type of rectifier is to allow energy flow in only one direction, because a reverse current cannot be conducted through the rectifier elements. However, the flow of energy in any circuit element can be reversed by changing either the direction of current through the element or the polarity of the voltage across the element. In a converter in which the conducting period of the elements can be controlled the polarity of the d.c. voltage can be reversed by making effective the opposite polarity of the a.c. voltage. This is the principle of operation of the inverter, which permits power to be transmitted from the d.c. circuit to the a.c. circuit.

With railroad service, the need for regeneration is indicated by a rise in the d.c. voltage. The effect of this on rotating equipment would be to reverse the direction of current flow, but with the rectifier the elements support the additional voltage and there can be no reverse current. A second converter with a reversed connection may be controlled so that the ignitrons can conduct during periods in which the a.c. voltages of their transformer windings are opposed to the flow of current. With this type of operation, energy can be transmitted from the a.c. circuit to the d.c. circuit by the rectifier and from the d.c. circuit to the a.c. circuit.

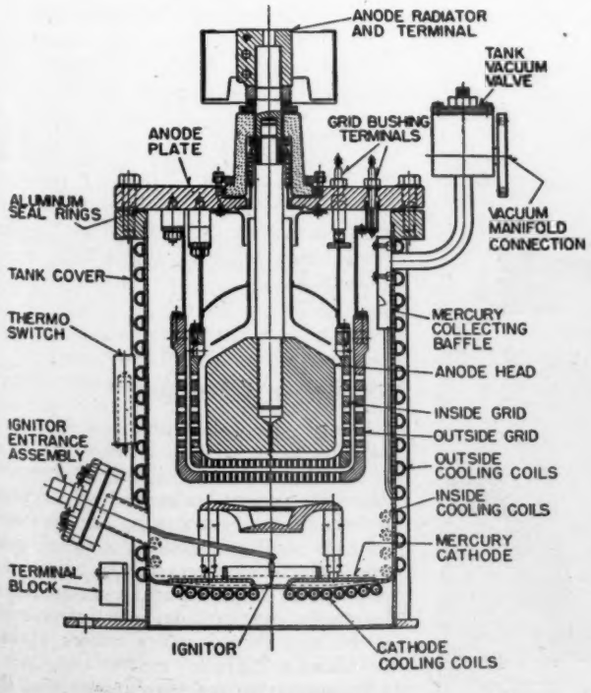


Fig. 3—Double grid high voltage ignitron

Sealed Ignitron Tubes

The possibility of using sealed ignitron tubes for the 3,000-volt class should be considered for some railway applications. Sealed ignitrons have been developed for voltages up to about 7,000 volts d.c. in single-way circuits, and economical designs could be obtained for 3,000 volts.

There should be no fundamental difference in the performance of pumped and sealed ignitrons. Up to the limit of size for which experience has been obtained in sealed-tube construction, any electrical design used in pumped tubes can also be used in sealed tubes with an equal rating.

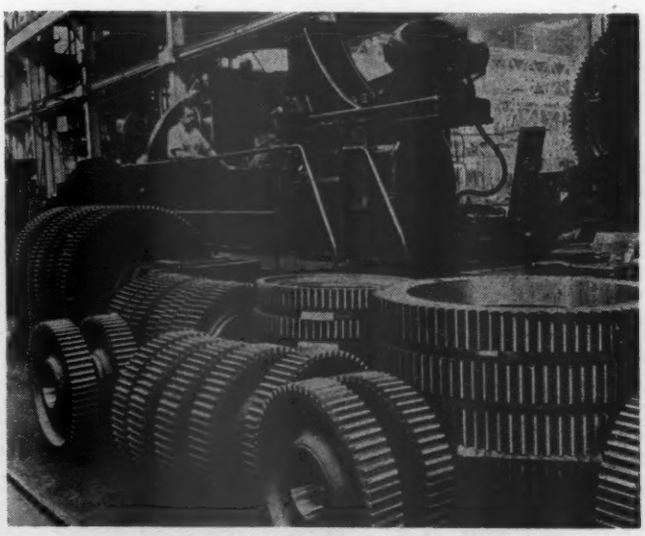
The decision as to whether pumped or sealed ignitrons should be used in a given application should be based on the relation between the required continuous and overload ratings and overload ratings and the available tube ratings. Economic considerations may be the determining factor for some current capacities.

High-voltage pumped ignitrons of an improved design have been built and tested for the requirements of 3,000- to 4,000-volt railway service. All of the circuit characteristics which are available with grid-controlled rectifiers and inverters are obtained by the use of ignitron control. Rectifiers and inverters can be used in one substation to provide the desired characteristics for either load or regeneration.

The high-voltage ignitrons are designed for heavy overloads of the type required for railway service. A new design of porcelain-enclosed glass Kovar sealed-anode bushing which has a temperature limit far above that obtained in normal operation has been developed.

The selection of either pumped or sealed construction for high-voltage ignitrons must be based on the rating, economic factors, and special requirements for each application.

* * *



Rim gears for electric locomotive drives and solid spur gears for Diesel electric service awaiting inspection and shipment at the Nuttall Works of Westinghouse. Two types of rim gears are in evidence; those with the ground finish bore are pressed on the drive mechanism, while others have a bolt circle to facilitate mounting

NEW DEVICES

Robot Packing Retainer

The Robot journal-box packing retainer, recently developed by the Chicago Freight Car & Parts Co., Chicago, is designed to provide a reliable mechanical means of holding packing away from the brass at all times; keep the journal clean, from the packing line to the brass; and provide a clean film of oil.

The Robot retainer consists of a flexible tempered spring-steel frame, equipped with two Bakelite laminated brushes, one on each side of journal, which are slidably attached to the retainer frame for necessary lateral movement. The normal position of brushes is about 45 deg. in relation to the side walls of the journal box and these brushes maintain a steady pressure of about 4 lb. per brush against the journal—enough to hold packing strands, but not enough to break the oil film which passes upward to the brass. The flexibility of the spring-steel frame is such that the retainer may be easily applied to or removed from a journal box. When in the box, it does not interfere with normal journal-box servicing and is not damaged by packing irons.

Advantages claimed for the Robot retainer include the elimination of time wasted in adjusting journal-box packing in terminals, which amounts to at least 50 per cent of the time consumed inspecting or servicing trains; time consumed in jacking journal boxes in yards to remove brasses due to waste grabs; delays to trains due to setting out cars on account of hot boxes caused by waste grabs; cut journals caused by waste grabs. This retainer is said to extend the average service life of the brass at least 100 per cent and result in increased service life of the packing, which will not be cut up into short strands by the use of packing irons.

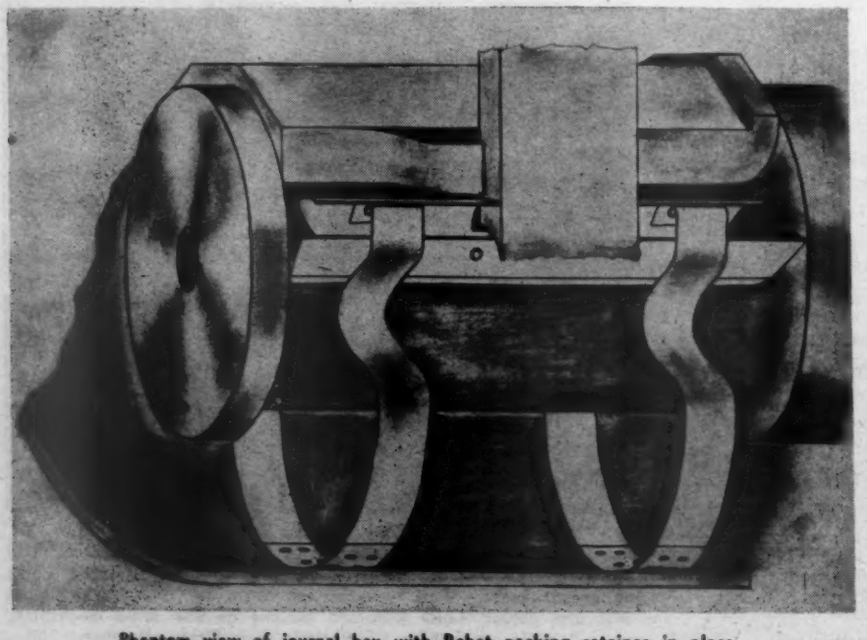
Tests to determine the efficiency and potential service life of the Bakelite laminated brushes indicate that these brushes serve to distribute the oil film evenly along the full length of the journal and at the same time allow a heavy oil film to pass, thereby constantly maintaining a surplus of oil in the oil groove along the edge of the brass and providing lubrication uninterrupted by waste grabs. With this full lubrication, the amount of wear on the brush contact edges is practically negligible.

Robot retainer (on block) ready for application in a journal box

Heat-Resistant High-Dielectric Tape

A remarkable tape made by coating fibreglass with Silastic is currently available to the electrical industry. Known as Cohrlastic, this tape has very high dielectric properties—1,100 volts per mil—and the capacity to retain this strength up to 500 deg. F without breaking down and carbonizing. It is resistant to arcing and corona cutting, as well as being water proof and water repellent.

Cohrlastic is not sticky; wraps are bound at the ends. Gaskets may be die cut for applications requiring high dielectric strength at elevated temperatures. Cohrlastic is available in rolls of various lengths, widths, and thicknesses from the Connecticut Hard Rubber Company, New Haven, Conn.



Phantom view of journal box with Robot packing retainer in place

Da-Lite Control Blinds

Additional comfort to the occupant of the sunny side of a car is attained by the installation of Da-Lite control blinds, the use of which lessens the extreme variations of daylight intensity found on shade-equipped cars. These blinds provide subdued daylight inside the car and reduce eye strain by giving the passenger a non-glare view of passing scenery.

Da-Lite control blinds provide diffusion of daylight and a non-glare view of the scenery

Built for railroad use, the construction eliminates cords, chains and knobs. The bottom control bar is made of polished aluminum, and has the control mechanism completely enclosed. The movement of the bottom bar opens, closes and adjusts the slats. When raised or lowered, the blind will remain at the desired level. Da-Lite blinds were designed by the Ajax Consolidated Company, 4615 West 20th. street, Chicago 50.

Syphon Cleaner

A rotary type scale-cutting tool for cleaning locomotive syphons is being marketed by the Flannery Bolt Company, Bridgeville, Pa. This device, known as the Reynolds syphon cleaner, operates on an expansion principle similar to that of a flyball governor. The four cutter arms are heavy steel bars so that the centrifugal force acting on their outer ends provides effective pressure of the cone-shaped rotary cutters against the scaled surfaces.

To assure the unform expansion of the cutter circle diameter for all four cutters,

The Reynolds syphon cleaner collapses for easy insertion, and can be safely used in the stay-bolted section

the arms are secured by links to a single collar sliding on a circular stem. This interlocking of the cutter arms permits cleaning in the stay-bolted section by preventing entanglement between the stay-bolts. The tool collapses to a small diameter and can be inserted freely through the washout plug holes into the syphon.

The cleaner is built of alloy steel. High-speed steel, heat-treated and high-cased, is used for the cutters. The cutter pins are made of heat-treated alloy steel.

Induction Transmitter-Receiver

A mobile induction transmitter-receiver has been designed by the Aireon Manufacturing Corp., Kansas City, Kan., for "carrier" communication with wayside stations. Using a frequency-modulated carrier of 50 watts power, the unit enables the conductor or engineman on a moving train to talk with wayside stations up to 50 miles distant. Communication between trains is slightly less, but reliable contact can be obtained up to 25 miles. Frequency range of the equipment is 70-200 kc., the band which has been assigned for this type of service.

The unit, which is shown in the photograph without cover and shock mounting, is 8 in. high, 10 in. wide, and 20 in. deep. The equipment is pretuned and remotely operated. It can be mounted in a steel weather-proof box on the tender. This box, which contains transmitter-receiver and separate power supply measures 15½ in. by 23½ in. by 24 in.

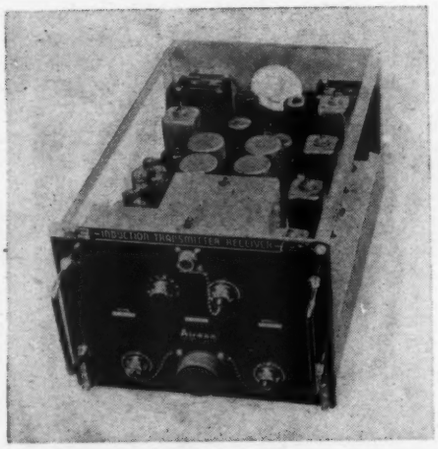
Power supplies are made as a separate unit because of the variety of power sources found on trains. A dynamotor is available for 32 volts or 62 volts d.c. and a conventional rectifier tube type for 117-volt a.c. sources. Power supply dimensions are the same as those of the transmitter-receiver. The usual power source is the headlight generator on the locomotive or an axle-driven generator and storage batteries for the caboose.

The transmitter-receiver shown draws 100 watts on standby and 300 watts when transmitting. It uses two 1,625 tubes for R-F power amplifiers, a pair of 6V6 tubes for audio output amplifier.

The antenna for this equipment is a large single-turn loop, the style of which varies with the installation. In a caboose installation, a single-turn loop is run around the car; and on steam locomotives, a single-wire loop is run the length of the boiler, along insulated supports.

The F-M receiver which is a part of the unit delivers up to 6 watts undistorted power to a permanent-magnet call speaker and handset.

Remote-control equipment for this set consists of an Electrovoice handset and



Aireon mobile induction transmitter-receiver

an Aireon 1030B remote unit. Controls consist only of squelch and volume control. "Send-receiver" lights and call speaker warn the user when he is being called.

Plastic Lens Coating

A baked plastic lens coating offers protection to welding lenses from weld spatter. The photo shows the difference in the accumulation of weld spatter on the coated and on the uncoated portions of the lens.

The latter would be unusable, whereas the coated portion is scarcely affected.

Smudge or smoke may be wiped from the lens with a damp rag without harming the coating. This lens is available for goggles, helmets, and handshields from the Eastern Equipment Company, Inc., Willow Grove, Pa.

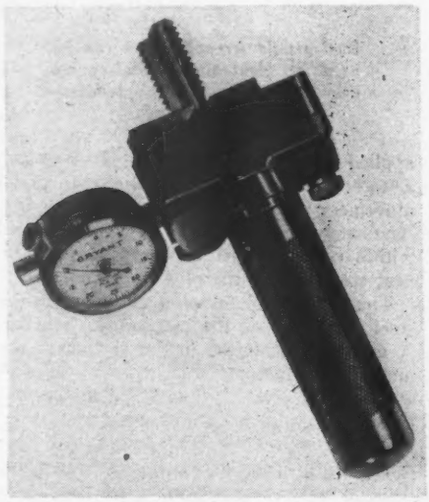
Effect of weld spatter on a partially coated lens

Portable Thread Gauge

Fast, accurate inspection of threads is said to be possible with the Bryant portable thread gauge. Gauges are available for inspecting either internal or external threads from the Bryant Chucking Grinder Company, Springfield, Vt.

Models for either type of thread have two stationary and one movable thread segment. After insertion, only a partial turn of the work or of the gauge, depending upon the type of thread, is required to indicate inaccuracies of lead, pitch diameter, and thread form, as well as any out-of-roundness. Inspection of different sized or different type threads is accomplished by changing the thread segments and aligning them to a master gauge or plug.

To accommodate all classes of fits the segments are made to Class W tolerances. Thread forms of either the "Go" or "No Go" type are available in sizes from 7/16



Bryant gauge for inspecting internal threads

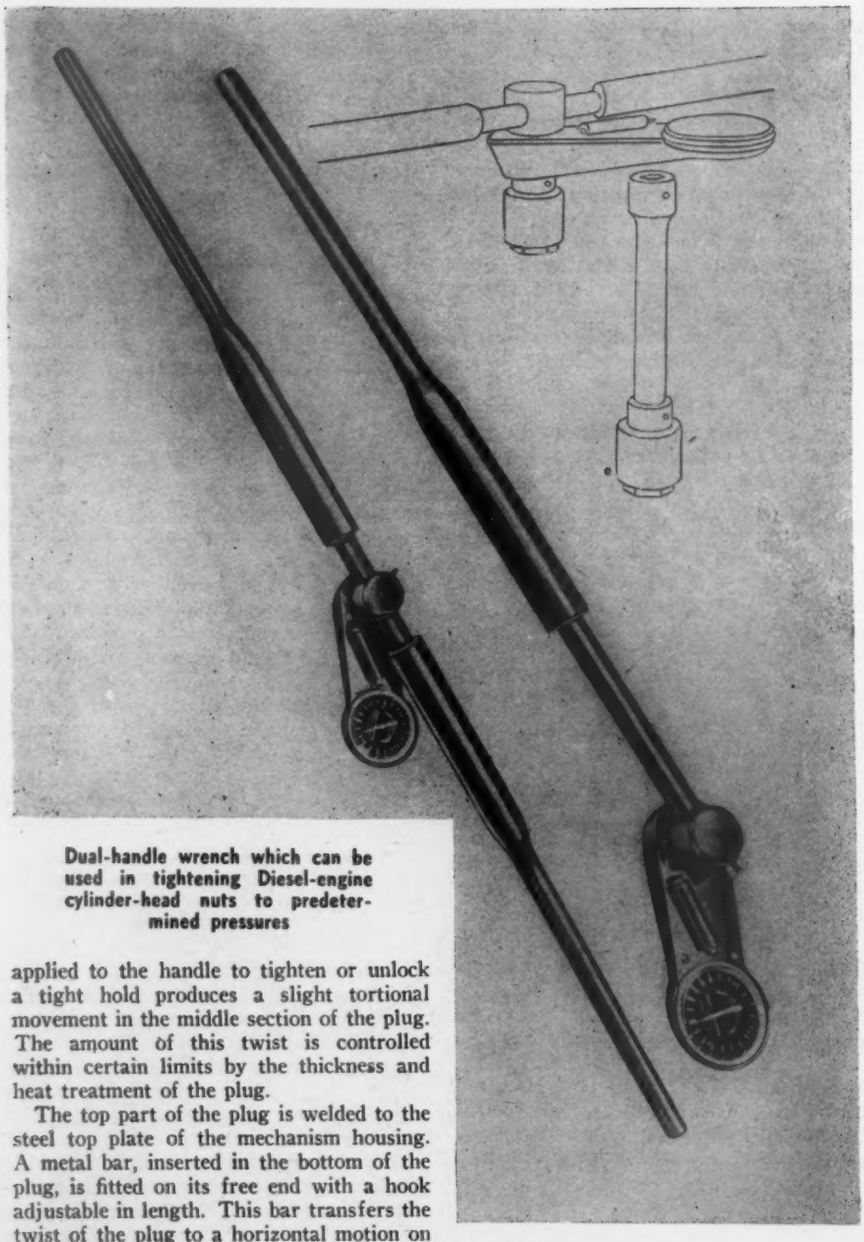
in. to 1 in., and from 1 in. to 3 in. The dial indicator reads in thousandths of an inch and can be used to advantage to check tolerances.

Dual-Handle Tension Wrench

A dual-handle tension wrench, or Torqometer, with built-in indicating dial and flash bulb to show when desired pressures are secured has been developed by the Snap-on Tools Corporation, Kenosha, Wis.

The section of the tool through which the sliding handle passes is a plug which extends down through the mechanism housing and ends in a square drive plug at the bottom to which the necessary size of socket wrench or extension shank is attached.

The torsion on the plug when pressure is



Dual-handle wrench which can be used in tightening Diesel-engine cylinder-head nuts to predetermined pressures

applied to the handle to tighten or unlock a tight hold produces a slight tortional movement in the middle section of the plug. The amount of this twist is controlled within certain limits by the thickness and heat treatment of the plug.

The top part of the plug is welded to the steel top plate of the mechanism housing. A metal bar, inserted in the bottom of the plug, is fitted on its free end with a hook adjustable in length. This bar transfers the twist of the plug to a horizontal motion on the hook ends. The hook engages a precision-made gear arrangement which, in turn, actuates the needle of the dial.

At the zero point of the dial there is a small metal stop which, upon contact with the pointer, completes an electrical circuit which, in turn, lights a small flash bulb in the holder on top of the tool. The tool is used as follows: For example, assume that it is required to tighten a bolt to 1,500 ft.lb. The dial is turned until the 1,500 ft.lb. mark is opposite the dial needle and pressure is applied on the Torqometer handles and the bolt tightened until the needle reaches the zero mark. Under normal lighting conditions this can readily be observed, but under poor lighting conditions the second the needle reaches zero it completes the electrical circuit, and the flashlight operates, notifying the operator that the required tension has been reached.

This particular Torqometer was developed primarily for use in tightening the various large nuts found on the cylinder heads of Diesel locomotives where space is limited and does not provide enough room to use properly a single-handle Torqometer of the same torque capacity.

In addition to this special double-handle model, Snap-on Torqometers are available in other capacities including: 150 ft.lb.; 250 ft.lb.; 350 ft.lb.; 600 ft.lb.; 1,000 ft.lb.; 2,000 ft.lb. The construction of these tools is identical, although the size of the mechanism and plug increases as the models increase in size.

Flexible Tubing Coupling

A coupling which eliminates the need for fittings, but which makes possible the rapid joining or disconnecting of flexible tubing has been developed for Spiratube, a non-collapsible, retractable tubing.

Assembling two sections of Spiratube

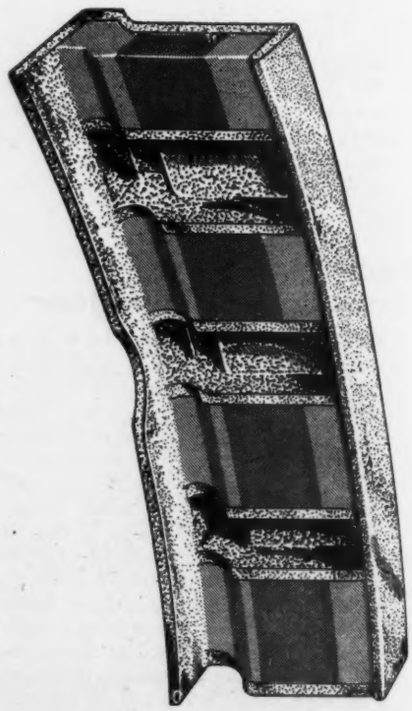
The coupling, a flat spring-steel collar built in the tubing, is compressed to slip inside the end of another section and then released to form the joint. Disconnecting is accomplished by compressing the inner spring-steel collar and withdrawing the male end.

Couplings and tubing are covered with a long-fibre duck fabric which has been processed fire-resistant and coated with thermoplastic. The Spiratube has no exposed metal inside or out, rendering it safe in the presence of explosive or inflammable materials. It is manufactured by the Warner Brothers Company, Spiratube Division, Bridgeport, Coon. and may be purchased in standard diameters from 3 in. to 16 in. and in lengths of 10, 15 and 25 ft.

Brake Shoes For Grinding Wheels

Wheel-grinding brake shoes are designed to remove defects in car and locomotive wheels while the unit is continued in service. Flat spots, high flanges, worn hollow tread, and other defects are correctable by removing the standard brake shoe and installing the grinding shoe with the appropriate abrasive contour.

The various shapes for correcting one or more of these defects with a single form are made to fit standard brake heads and wheels of any diameter. According to the manufacturer, the Dearborn Railway Specialty Company, 13011 Ford road, Dearborn, Mich., these shoes are processed and baked with the same care and precision used in the finest tool steels, and will last for several corrections.



Wheel-grinding brake shoes correct worn wheels without shopping

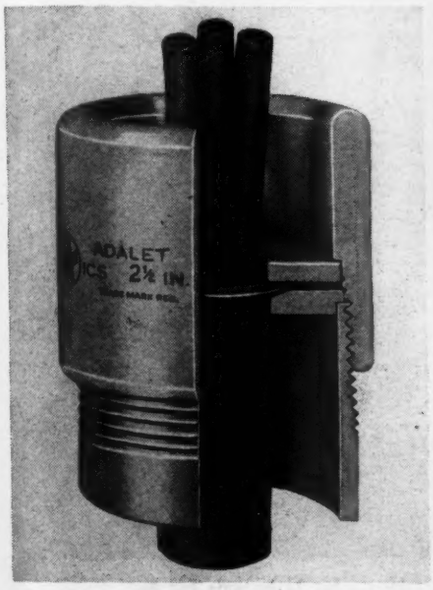
End Fitting for Asbestos Conduit

The most recent addition to the line of Sali insulating brushes is an end fitting for asbestos-cement conduit. The cover is regularly furnished blank, but may be drilled at the factory at additional cost.

Companion items are Sali insulating couplings, both male and female types, for joining asbestos-cement conduit to steel conduit and for use where asbestos-cement conduit is brought directly to the cabinet or pull box without the use of steel conduit extensions.

Sali is a phenolic laminated material, developed and used exclusively by the Adalet Manufacturing Company, Cleveland, Ohio. The standard line comprises many types of bushings for regular and thin-wall steel conduit.

Sali has high mechanical and dielectric strength. It has the distinctive quality of adhering to metal; the phenolic varnish acts as a binder, so that the fitting will not vibrate loose. Sali fittings are designed for use where space is limited, and neat appearance and strength are required.

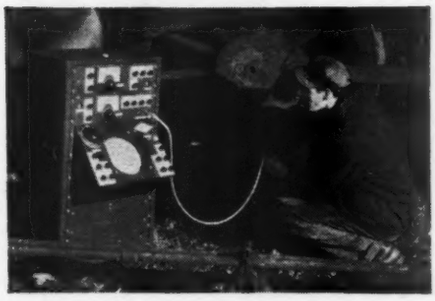


Sali insulating bushing for asbestos-cement conduit

These fittings are recommended for use on all conduits terminating at switchboards, control boards, power cabinets, pull boxes, safety switches, motor starters, controllers, cranes and other devices where high insulation must be combined with strength. They may be used on installations where vibration normally causes the insulation on the cable to break down.

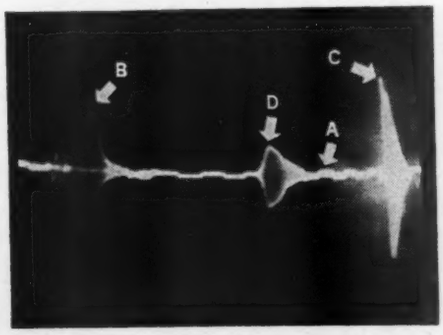
Non-Destructive Testing Device

The Super-Sonic Reflectoscope is a device for detecting quickly internal cracks and flaws without disassembing the equipment to be tested. The machine gives a depth of penetration up to 10 ft., indicates the position of the defects, and is portable and shock mounted.



Testing a crank pin with the Supersonic Reflectoscope

For testing locomotive axles and crank pins, a quartz crystal searching unit is moved slowly around the flat surface, which has been pre-oiled to improve sound transmission. Defects will show on the oscilloscope screen, as indicated by *D* in the illustration. This indication is a result of the transmitted sound wave being reflected from the edge bordering on the defect. An interruption of continuous surface as small as the border between two parts shrunk-fit to each other will give an indication on the screen.



The oscilloscope screen showing the zero sweep line, *A*; the initial pulse, *B*; and the reflection from the opposite side, *C*. The defect is at *D*

For most parts, access is required to one side of the material only. Best results are obtained by testing from the end of the largest diameter as the sound waves are emitted from the crystal in a straight line and would not cover the area contained in the ring between the two diameters while transmitting axially. Some success may be had by tilting the crystal, but this method will leave part of the material unsearched. Therefore, crank pins are tested better from the inside, while axles should be checked from both sides.

The Supersonic Reflectoscope is available to the railroads under lease from the Sperry Products, Inc., Hoboken, N. J. All servicing and maintenance is performed by the lessee.

Waste Retainer For Journal Boxes

The Gorman journal waste retainer is designed to prevent waste climbing up the sides of the box and pinching between the journal and the brass. Wide 16-gauge plates fit snugly around the journal and hold the waste firmly down under spring pressure. The retainer acts as an automatic doper; the vibration set up in the box by the car motion causes a flexing of the spring against the plates which squeezes the waste and makes the oil flow through it to the journal surface.

The use of this retainer is said to reduce the necessity for setting-up or adjusting the waste at yards and terminals, limiting attention to the addition of oil.

This device is manufactured by the Agee Metal Products Company, 3442 Cliff Road, Birmingham 5, Ala. for use on locomotive tenders, and on passenger and freight cars.

The Gorman journal waste retainer is designed to eliminate waste grabs

Synchronous Motor Welder

By utilizing the built-in separate exciter of their electric-drive welder, the Hobart Brothers Company, Troy, Ohio, has produced a compact synchronous welder. The unit is so proportioned that it can be started across the line and will automatically synchronize itself by the build-up of the separate exciter.

This welder helps to correct low power factor

The motor for this welder is a Hobart revolving-field synchronous type with a heavy squirrel cage winding for starting as a conventional induction motor. Once up to speed, the exciter builds up and automatically applies correct excitation to motor fields.

This unit operates at a unity or leading power factor, making its usage economical to both the consumer and the supplier of electricity. For emeregency use the shaft can be coupled to a gasoline or electric motor and the synchronous motor will serve as an alternating current generator.

Steam Cleaning Unit

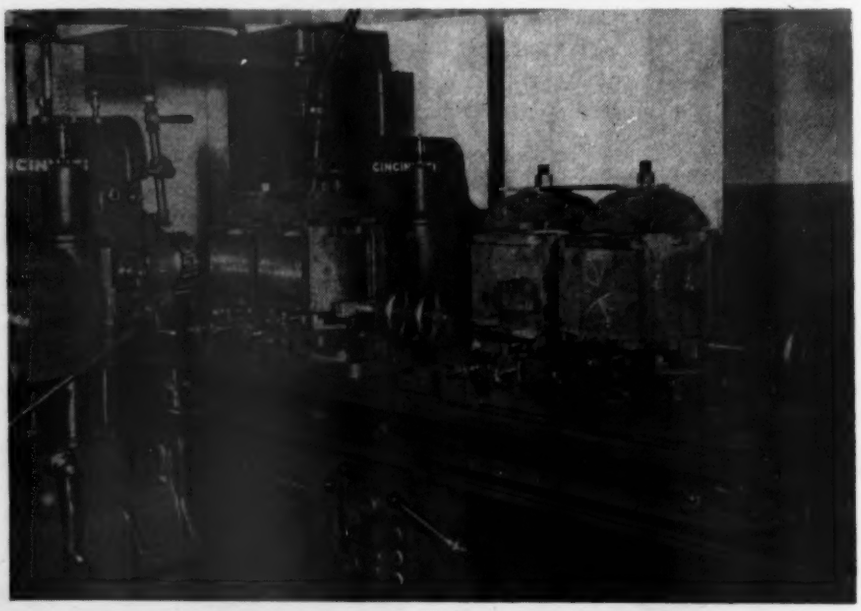
A portable steam cleaning unit, weighing 28 lb, has been developed by The Turco Products, Inc., 6135 South Central avenue, Los Angeles, Calif. that utilizes existing steam lines to clean anything from finely finished aluminum surfaces to heavy equipment caked with grease. The device will operate from any steam line which has a ¼-in. valve outlet and maintains a pressure range of from 80 to 150 lb. per sq. in.

The Turco cleaning units operate from existing steam lines

The cleaning fluid is contained in an ordinary 55-gal. drum from which it is drawn by the unit and mixed with steam for the cleaning operation. Three manual controls vary the temperature, quantity of solution. and nozzle pressure to suit the job at hand. There are no moving parts, pumps, pressure tanks, motors, or electrical connections. A variety of non-toxic, non-explosive cleaning fluids for use through the unit are available from the manufacturer.

Hydromatic Milling Machine

A line of hydromatic milling machines having the cutting capacity and spindle speeds for high-speed carbide milling is announced by the Cincinnati Milling Machine Company, Cincinnati 9, Ohio. These machines are of bed-type construction, with automatic table feed cycles and infinitely variable hydraulic table feeds. Twelve sizes are available in plain and duplex styles with table traverse varying from 24 in. to 90 in.



Cincinnati Hydromatic milling machine taking a cut 11 in. wide and ⅜ in. deep in cast-steel journal boxes

Counterweights for the spindle carriers minimize the effort required to adjust the carriers vertically, while a quick clamping arrangement for the quills facilitates cross adjustment. Both spindle carriers and quills are equipped with a vernier and scale device for direct reading of adjustments exceeding one turn of the hand crank. An independent electrical control for vertical rapid traverse movement of the spindle carrier is used for machines employed for a variety of milling operations requiring frequent adjustments of several inches.

Lubrication is automatic with the exception of four oil cups on the plain and eight on the duplex machines. A float switch automatically stops the driving motor when the oil drops below the safe limit.

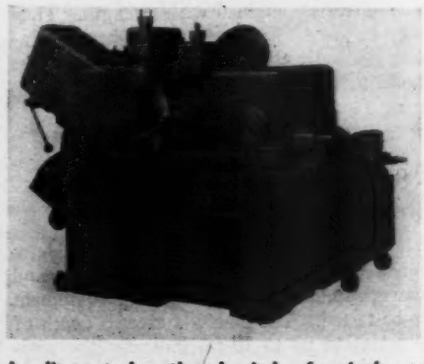
To save manual labor on the part of the operator the spindle rotation is stopped and started by hydraulics. A small lever controls the hydraulic pressure which engages and disengages the spindle drive clutch.

Centerless Thread Grinder

Screw threads may be ground on straight cylindrical work pieces as well as on headed or multiple-diameter parts by the No. 1 centerless thread grinder manufactured by the Landis Machine Company, Waynesboro, Pa.

This machine can be used to grind threads from solid blanks or to finish threads cut prior to grinding. The "Thrufeed Method" is used to grind single-diameter parts in a continuous flow between the grinding and regulating wheels. Multiple-diameter parts are thread-ground by the "Infeed Method", which completes the entire thread in approximately 1½ revolutions of the work piece. Work rests for either type of feed are adjustable for any helix angle within the range of the machine.

A heavy-duty automatic crush dresser attached directly to the bed of the machine forms the threads to a pre-selected depth on the grinding wheel. A geared motor incorporated in the dresser drives the crusher roll and grinding wheel at slow speed when dressing. The motor control is interlocked with the main driving motor controls to prevent contact between the crusher roll and the grinding wheel when the latter is rotating.



Landis centerless thread grinder for single- or multiple-diameter work pieces

One profile diamond-type dresser is mounted over the grinding wheel and one over the control wheel. To form the face of either wheel to any desired contour, the dresser may be equipped with profile cams. These cams can be locked out of engagement when straight faces are desired on the wheels. Dressing can be done without disturbing the set-up of the machine.

The 4⅛-in. diameter grinding-wheel spindle rotates in multiple-shoe, self-adjusting, heavy-duty bearings, pressure-lubricated and is fitted with a device to stop the machine in event of a lubrication failure. A 15 hp. constant-speed motor drives the grinding wheel through V-belts. A worm-and-worm-wheel drive is used for the control wheel spindle; this spindle rotates on ball bearings and is mounted in a swivel housing. The coolant system for these wheels has a 65-gallon tank and a 1 hp. centrifugal pump. Provision is made for installing a control unit to maintain constant coolant temperature.

All electrical controls are grouped in a single panel. A master control button is included to stop the entire machine in one operation. When setting up, the grinding wheel, the control wheel, and the coolant pump may be stopped in one operation. To make the machine fully automatic in operation except for dressing the wheels and making size adjustments, an automatic hopper is available for feeding the work in thru-feed grinding.

Reusable Hose Couplings

Hand assembly of flexible hose lines has been made possible by a patented metal coupling which can be attached or detached on the spot with the proper size wrench.

The coupling nut threads on the hose, the end of which is compressed to form a safety-seal gasket. The double-bell-shaped nut permits flexing of the hose but tends to prevent cutting. A long grip on the fitting restrains the hose from coming loose.

These two-piece couplings were developed by the Resistoflex Corporation, Belleville, N. J.

Portable Metal-Cutting Saw

Shown in the illustration is a 14-lb. general utility saw of cast aluminum construction for small work. The cutting range is ⅛ in. to 1⅛ in. round or irregular shapes of metal, wood, or plastic.

The saw, powered by a 110-volt motor, is fed through the work by the hand-feed crank, the work being clamped in the hardened-steel vise jaws. The high-speed steel saw cuts square to the surface, and is stopped and started by a handle-mounted switch.

A special vise designed for converting the saw into a bench tool is also available from the manufacturer, the Machine-Craft Manufacturing Company, 3805 Avalon Boulevard, Los Angeles 11, Calif. Wing screws on the vise facilitate return of the saw to portable status.

Portable metal-cutting saw

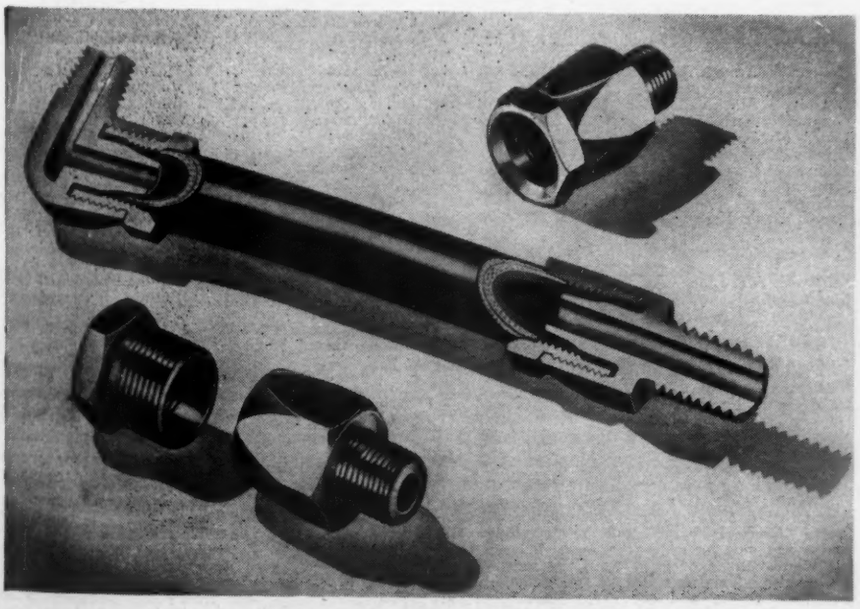
Automatic Battery Charger

A motor-generator set for charging industrial truck batteries of either the lead-acid or nickel-iron type is fully automatic in operation and will charge the batteries without lifting them from the truck.

The setting of the interval timer automatically starts the machine and shuts it down at the end of a pre-set charging time, during which the charging rate is automatically controlled by the modified constant-voltage generator. In the event of a power failure, an automatic reverse-current cutout disconnects the battery, and reconnects it upon the return of the power.

The generator is a 15-16-volt d.c., 50-amp., ¾-kw. diverter-pole type. It is built as an integral unit with a 3-phase a.c. 220/440-volt, 60-cycle, 1½-hp. squirrel cage induction motor mounted on ball bearings. In the control cabinet are a d'Arsonval type ammeter and the various controls. This ¾-kw. set, as well as special models for all types and sizes of batteries, is made by the Hobart Brothers Co., Troy, Ohio.

Automatic industrial truck battery charger



Reusable hose couplings for hand assembly

NEWS

Dates of Meetings Changed

THE sessions of the Mechanical and Purchasing and Stores Divisions, Association of American Railroads, scheduled for June 20 and 21, and the Railroad session of the American Society of Mechanical Engineers scheduled for June 19, all at Chicago, have been postponed until later in the year.

The date of the meeting of the Electrical Section, Mechanical Division, Association of American Railroads, has been changed to October 23, 24 and 25. It will be held in the Hotel Sherman, Chicago, and the Railway Electric Supply Manufacturers Association will hold an exhibit.

Forum Honors Westinghouse

THE George Westinghouse Centennial Forum, the general theme of which was Science and Life in the World, organized in celebration of the one-hundredth anniversary of the birth of the great inventor and developer, brought together more than 700 of the leading scientists, engineers and scholars of America at Pittsburgh, Pa., on May 16, 17 and 18 for the consideration of a program of symposia and addresses which dealt with atomic energy, transportation, communications, biological science, and future progress in science and engineering, all from the aspect of their relation to civilization at home and in the world at large. The Forum, sponsored by The Westinghouse Educational Foundation, included a symposum on "Transportation—A Measurement of Civilization" which was addressed by Dr. Edward Warner, president of the Interim Council, Provisional International Civil Aviation Organization, by Vice Admiral Emory S. Land, U. S. Navy (retired), and former chairman of the U. S. Maritime Commission; by Martin W. Clement, president, Pennsylvania Railroad; by A. G. Boeghold, head, metallurgical department, research laboratory, General Motors Corporation, representing Dr. Charles F. Kettering, and by Harland Bartholomew, of Harland Bartholomew and Associates, who spoke on transportation planning in urban areas.

Among the speakers at the symposium on the Future of Atomic Energy, Dr. Enrico Fermi, professor of physics, University of Chicago, dealt with the Power. "If we try to look into the future," said he, "and take the optimistic point of view that mankind may succeed to organize itself so as to eliminate the fear and the danger of the destruction potentialities of atomic weapons, one might speculate as to what may happen to atomic energy as a constructive new force." From his discussion several pertinent points stand out. These are: (1) the "piles" operated at Hanford, Wash., for the synthesis of plutonium produce energy in amounts comparable to that of the largest hydro-electric plants; (2) the energy so far produced is delivered at temperatures too low to be of practical use; (3) there is no known practical limitation of the temperature at which energy can be produced by a fisson chain, subject to the limitation imposed by the refractory properties of the materials used; (4) the choice of the materials is critical because of the adverse effect that adding foreign materials in the reaction system has on the nuclear reaction.

The essential fuel in the "piles" of the Hanford type, is the uranium isotope known as U235 which represents only 0.7 per cent of the total weight of natural uranium. Dr. Fermi pointed out that the content fisson energy in uranium is roughly three million times that of an equal weight of coal, but where only 0.7 per cent of the uranium is utilized, the practical uranium to coal ratio would be about 20,000. "If we conceive," said he "a development in which large amounts of atomic energy would be produced by the U235, the rich deposits of uranium would rapidly be exhausted and further production would have to use very poor ores with a consequent increase of several orders of magnitude in the cost of the primary material." However, he compared three million tons of coal, costing eight million dollars, as equivalent in energy content to one ton of uranium, which would balance at a price of uranium at four thousand dollars per pound. Before the war the cost, he said, of uranium was about two dollars per pound.

Dr. Fermi considered it conceivable that twenty or thirty years hence there may be large central installations in which great amounts of power will be produced. They may also produce some amount of plutonium which may be extracted and distributed to small installations to become the primary fuel.

"It does not appear possible," he said, "to design an atomic power unit light enough to be used in a car or in a plane of ordinary size. Perhaps a large locomotive may be the smallest mobile unit in which an atomic power plant conceivably could be installed."

In all, four symposia were held on Thursday and Friday at the Syria Mosque and individual addresses were delivered during luncheon and dinner sessions at the Schenley Hotel, at which the sponsoring organization was the host. Saturday morning was devoted to an inspection trip through the Mellon Institute of Industrial Research.

Orders and Inquiries for Equipment Placed Since the Closing of the May Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Atchison, Topeka & Santa Fe	1	6,000-hp. pass.	Fairbanks-Morse
New York Central	20	2,000-hp. pass.	Electro-Motive
	28 units	1,500-hp. frt.	Electro-Motive
	6 units	1,500-hp. frt. and pass.	Electro-Motive
	6 units	1,500-hp. frt. and pass.	Baldwin Loco.
	6 units	1,500-hp. frt.	American Loco.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Akron, Canton & Youngstown	25	Covered hoppers	American Car & Fdry.
Atchison, Topeka & Santa Fe	750	50-ton box	Pullman-Standard
	100	Caboose	Company shops
Bangor & Aroostook	100	50-ton rack	Magor Car
Chicago Great Western	25	70-ton covered hopper	Pullman-Standard
Detroit & Mackinac	150	50-ton box	General American
Great Northern	25	70-ton covered hopper	American Car & Fdry.
Gulf, Mobile & Ohio	1,000	50-ton box	American Car & Fdry.
Illinois Terminal	200	50-ton box	American Car & Fdry.
Minneapolis & St. Louis	250	50-ton gondola	General American
Minneapolis, St. Paul & Sault Ste. Marie	20	Covered hopper	American Car & Fdry.
Pacific Fruit Express	500	40-ton refrigerator	American Car & Fdry.
	500	40-ton refrigerator	General American
	500	40-ton refrigerator	Pullman-Standard
	500	40-ton refrigerator	Pacific Car & Fdry.
Seaboard Air Line	200	70-ton phosphate	Pullman-Standard
Southern	1,000	50-ton box	Pullman-Standard
	600	50-ton gondola	Pressed Steel
	250	70-ton ballast	American Car & Fdry.
	150	70-ton covered hopper	Harlan & Hollingsworth

FREIGHT-CAR INQUIRIES

Baltimore & Ohio	200	50-ton auto-box
Delaware & Hudson	200-400	50-ton gondola
Donner Hanna Coke Corp.	100	70-ton hopper
New York, New Haven & Hartford	30	50-ton air dump
Norfolk & Western	250	50-ton box
Missouri-Kansas-Texas	100	70-ton covered hopper

NOTE:—The Illinois Central has completel plans for building and placing in operation two new streamline daylight trains to run between Chicago and St. Louis, Mo. These units will replace the road's "Green Diamond" and the "Daylight" and will be powered by Diesel-electric locomotives, 24 of which are now on order for early delivery to the Illinois Central. According to present plans each train will consist of eight cars, the first of which has tentatively been designated as a baggage-crew lounge car. This unit will be followed by a tavern coach with a bar, three coaches, a dining car, one parlor-lounge car and one parlor-observation car. The coaches for both trains will be built by the Pullman-Standard Car Manufacturing Company while the "specialty" cars will be made by railroad forces in the company shops.

Shop Safety

SAFETY in locomotive shops and roundhouses is the subject of a new sound slidefilm, entitled "Men and Motive Power," just completed by the National Safety Council.

Based in part on a recent analysis of more than 500 railroad shop accidents, the film provides concise, pointed and clearly illustrated instruction for railroad shop workers.

Further information may be obtained from the National Safety Council, 20 North Wacker Drive, Chicago 6.

B. & O. Diesels in Freight Service Set New Non-Failure Road Record

THREE Diesel-electric freight locomotives, built by the Electro-Motive division of General Motors Corporation, and operated by the Baltimore & Ohio between Cumberland, Md., and Washington, Ind., recently set a record when they completed a total of 1,058,000 miles without a breakdown. The individual records for the locomotives were 337,000, 362,000 and 359,000 miles, and extended from time of delivery to the B. & O. in August, 1943, to April 23 of this year.

An impressive part of the record was established in the two years between January 20, 1944, and January 31, 1946. During this period the locomotives accumulated perfect performance on a combined locomotive mileage of 850,299 and produced a total of 2,663,541,000 gross ton-miles without a breakdown.

Each locomotive operates a total of 11,058 miles each three-day period and is allowed a two-hour turnaround period at Cumberland and a six-hour layover at Washington.

"Color Dynamics" To Be Used in A. C. L. Shop

"COLOR dynamics," a relatively new science, is being incorporated into the construction plans for new railroad shop facilities now being erected at Montgomery, Ala., officers of the Atlantic Coast Line have announced.

The experiment, first of its kind on the system, is designed to improve safety conditions, raise employee morale and reduce tension and fatigue of workers. If results prove satisfactory, consideration will be given to a similar program in other facilities along the line.

In practice, several restful colors are used in surroundings to relieve eye strain, monotony and resulting laxity which provokes accidents. Bright colors are applied at vital operating points such as switches, moving parts of machines, fire-fighting equipment, in order that these spots will always be strikingly visible to workers.

Diesel Locomotive Inventory 4,603,930 Hp.

ACCORDING to statistics compiled by the Railway Age, there were 4,387 Diesel locomotive units in service on domestic railways as of December 31, 1945, including 3,946 owned by Class I railways, excluding terminal and switching companies, and 441 owned by terminal and switching companies and Class II and III roads. Class I railroads were operating 1,571 Diesel road locomotive units having a total of 2,347,260 hp. and 2,375 switchers with a total of 1,920,910 hp.

The Diesel locomotive inventory of Class I roads was increased in 1945 by 773 units, of which 267 were of 1,350 hp., 150 of 2,000 hp. and the remainder of 1,000 hp. or less.

Diesel Locomotive Units in Service—Class I Railways

	Freight locomotive units		Passenger and comb. pass. and frt. locomotive units		Total	
Horsepower	No.	Total hp.	No.	Total hp.	No.	Total hp.
2,000	....	.....	369	738,000	369	738,000
1,800	....	.....	37	66,600	37	66,600
1,350 or 1,500	1,048	1,414,800	48	64,800	1,096	1,479,600
1,200	....	.....	19	22,800	19	22,800
1,000	8	8,000	24	24,000	32	32,000
Less than 1,000	12	4,300	6	3,960	18	8,260
Total road loco. units	1,068	1,427,100	503	920,160	1,571	2,347,260
Switching loco. units	(Averaging approx. 809 hp. per unit)				2,375	1,920,910
Total rd. and sw. loco. units					3,946	4,268,170

Note:—441 Diesel locomotive units of 335,760 total horsepower are estimated to be in service on switching and terminal companies and on class II and III railroads.

Accident Attributed to Defective Hand Brakes

OPERATION of passenger-train cars with inefficient hand brakes, in violation of the Safety Appliance Acts, was found by the Interstate Commerce Commission to have been the cause, along with damaged air-brake equipment on the locomotive, of a passenger train moving out of control on a descending grade, resulting in a collision with a freight train that led to the injury of 10 passengers and 3 employees. The accident occurred January 1 on the Louisville & Nashville.

While running south about 65 miles an hour, the left guide yoke and left main rod of a 4-6-2 type locomotive, hauling a passenger train of 7 cars, "became broken" and the train stopped on a 1.22 per cent ascending grade with its rear end about 1.2 miles south of the nearest automatic signal to the north. As a result of the breakage on the engine, the air compressor and its discharge pipe to the main reservoir were damaged, causing loss of air pressure that rendered the air brakes inoperative. To hold the train on the grade the engineman placed a coal pick on the rail back of a driving wheel and the conductor applied the hand brakes on the first and second cars. About one-half hour later the train began to move backward, out of control. The engineman opened the throttle in an effort to stop, but this failed, and the train was moving about 10 miles an hour when it collided with a southbound freight train which was following it.

The freight stopped at the signal 1.2 miles back of the standing passenger train, which displayed stop-then-proceed, stopped again to pick up the flagman of the passenger train and then proceeded about 2,750 ft., when it was stopped by an emergency brake application because the passenger train was seen to be moving backward. The collision occurred immediately afterward.

The passenger train, the cars of which are owned by the Pennsylvania, was received from that road at Louisville. Prior to its departure the air brakes were tested and were said to operate properly, but no test was made of the hand brakes. Tests of the brakes made after the accident led to the following comment: "Following an emergency application, the (air) brakes of three cars remained applied in excess of 45 min., one released in 30 min., one released in 10 min., and one was inoperative. The brake of the car which released in 10 minutes did not apply with sufficient force to cause the brake shoes to be tight against the wheels. Tests of the hand brakes of the cars involved disclosed that the hand brake of the first car could not be applied because the brake rod fouled the body bolster. The brake shoes could not be moved closer than 1 in. from the wheels. The hand brake of the second car was inefficient because of improper adjustment of the foundation gear. When the hand brake had been operated the brake shoes at two locations were ¾ in. away from the wheels.

"The hand brake of the third car was inefficient as a result of rusted gears and a twisted chain which fouled the gear housing. When this brake was operated the brake shoes at two locations were ¾ in. away from the wheels and at the other locations they could easily be moved away from the wheels. One spoke in the brake wheel was broken.

"The hand brake of the fourth car was inoperative because the brake chain fouled the rib of the center sill. The hand brake of the fifth car could not be applied by one man, but was applied by the full exertion of two men. After full exertion by one man the brake shoes were ⅜ in. from the wheels. The hand brake of the sixth car could not be applied without the aid of a bar and then only after 2 min. of exertion by one man. The seventh car was so badly damaged in the accident that the hand brake could not be tested until repairs had been made. After repairs were made, the hand brake operated properly."

The cars, the report explained, are equipped with four-wheel roller-bearing trucks having foundation brake gear of the clasp type on all wheels. The air brake equipment consists of a D-22 control valve on each car, and a brake cylinder mounted on each side of each truck. The hand brake equipment of each car has gears adjacent to the brake wheel, which is mounted in vertical position. When actuated by the air brake system, braking pressure is applied on all wheels, but when the hand brake is operated pressure is applied on the wheels of one truck only.

A. S. M. E. Locomotive Test Code Committee Reorganized

In a reorganization of Committee No. 15 of the Power Test Codes Committees of the American Society of Mechanical Engineers, which has charge of the modification and interpretation of the Code for Testing Steam Locomotives, the following have been appointed: Lawford H. Fry (chairman), director of research, Steam Locomotive Research Institute Inc., 60 East Forty-Second street, New York 17; C. D. Barrett, assistant engineer of tests, Pennsylvania Railroad, Altoona, Pa.; W. F. Collins, engineer of tests New York Central, 466 Lexington avenue, New York 17; James E. Davenport, vice-president in charge of engineering, American Locomotive Company, 30 Church street, New York 8; Ralph Johnson, chief engineer, Baldwin Locomotive Works, Paschall Post Office, Philadelphia 42, Pa.; H. G. Miller, mechanical engineer, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee 3, Wis.; Henry B. Oatley, vice-president, The Superheater Company, 60 East Forty-Second street, New York; A. J. Townsend, vice-president in charge of engineering, Lima Locomotive Works, Lima, Ohio.

Supply Trade Notes

Fairbanks, Morse & Co.—*V. H. Peterson,* manager of railroad sales of the eastern division of Fairbanks, Morse & Co., at New York, has been appointed manager of the recently combined Diesel Locomotive and Railroad divisions, with headquarters at Chicago. He succeeds John W. Barriger, III, who has become president of the Chicago, Indianapolis & Louisville. Mr. Peterson, before joining Fairbanks, Morse, was assistant to the president and manager of the New York office of the Baldwin Locomotive Works.

V. H. Peterson

◆

Yale & Towne Manufacturing Company.—*Richard W. Meacham* has been appointed the Yale sales representative for the Alabama, Louisiana and Mississippi territory of the Stamford division of the Yale & Towne Manufacturing Co. to succeed *V. Waldron,* who has been transferred to the New England territory. Mr. Meacham has been serving in the Navy for the past 2½ years.

◆

Elastic Stop Nut Corporation of America.—*Charles E. Heintz,* general sales manager of the Elastic Stop Nut Corporation of America, Union, N. J., for the past two years, has been elected vice-president in charge of sales.

◆

Bowser, Inc.—*H. Cubbie Roane* has been appointed assistant district manager of the Atlanta, Ga., office of Bowser, Inc. Mr. Roane, whose territory will include North and South Carolina, Georgia, Florida, Alabama, Mississippi and eastern Tennessee, was formerly division lubrication engineer of the Gulf Oil Corporation.

American Hoist & Derrick Co.—*Raymond J. Dervey* has been appointed manager of the Pittsburgh, Pa., office of the American Hoist & Derrick Co., to succeed *Ralph Thomson,* who will take charge of the New York office.

◆

Dayton Rubber Manufacturing Company.—The Dayton Rubber Manufacturing Company has moved its New York offices and warehouse to the Harborside Terminal, 34 Exchange Place, Jersey City, N. J.

◆

The Weatherhead Company.—*J. A. Strachan* has been appointed sales manager of the Original Equipment Division of the Weatherhead Company of Cleveland, Ohio, covering the sales of all products to Original equipment manufacturers in the refrigeration, air-conditioning, railroad, marine, chemical, food and beverage processing, and dairy equipment fields. *D. W. Holmes* has been appointed sales manager of the Standard Parts Division covering all products sold through distributor channels. *T. V. Scott* is the newly appointed sales manager of the Liquefied Petroleum Products Division covering the Petroleum and L.P.G. equipment industries. All will make their headquarters at Cleveland, Ohio.

J. A. Strachan

◆

Bird-Archer Company, Ltd. — *E. L. Ruggles* has been appointed assistant general manager of the Bird-Archer Company, Ltd., Montreal, Canada, with headquarters in that city. Mr. Ruggles will have jurisdiction over all technical and service engineering work of the company. *Jack E. Koyle* has been appointed district manager, with headquarters in Winnipeg.

Aeronautical Products.—*Chas. Gross* has joined Aeronautical Products, Inc., Washington Court House, Ohio, as vice-president in charge of sales. *Edw. Jonke* has been appointed assistant to the president. Mr. Gross was at one time general manager of the Auto Railer Division of Evans Products Co., Detroit, Mich. More recently he has been general sales and advertising manager of the Murchey Machine & Tool Co., Detroit, Mich.

Chas. Gross

◆

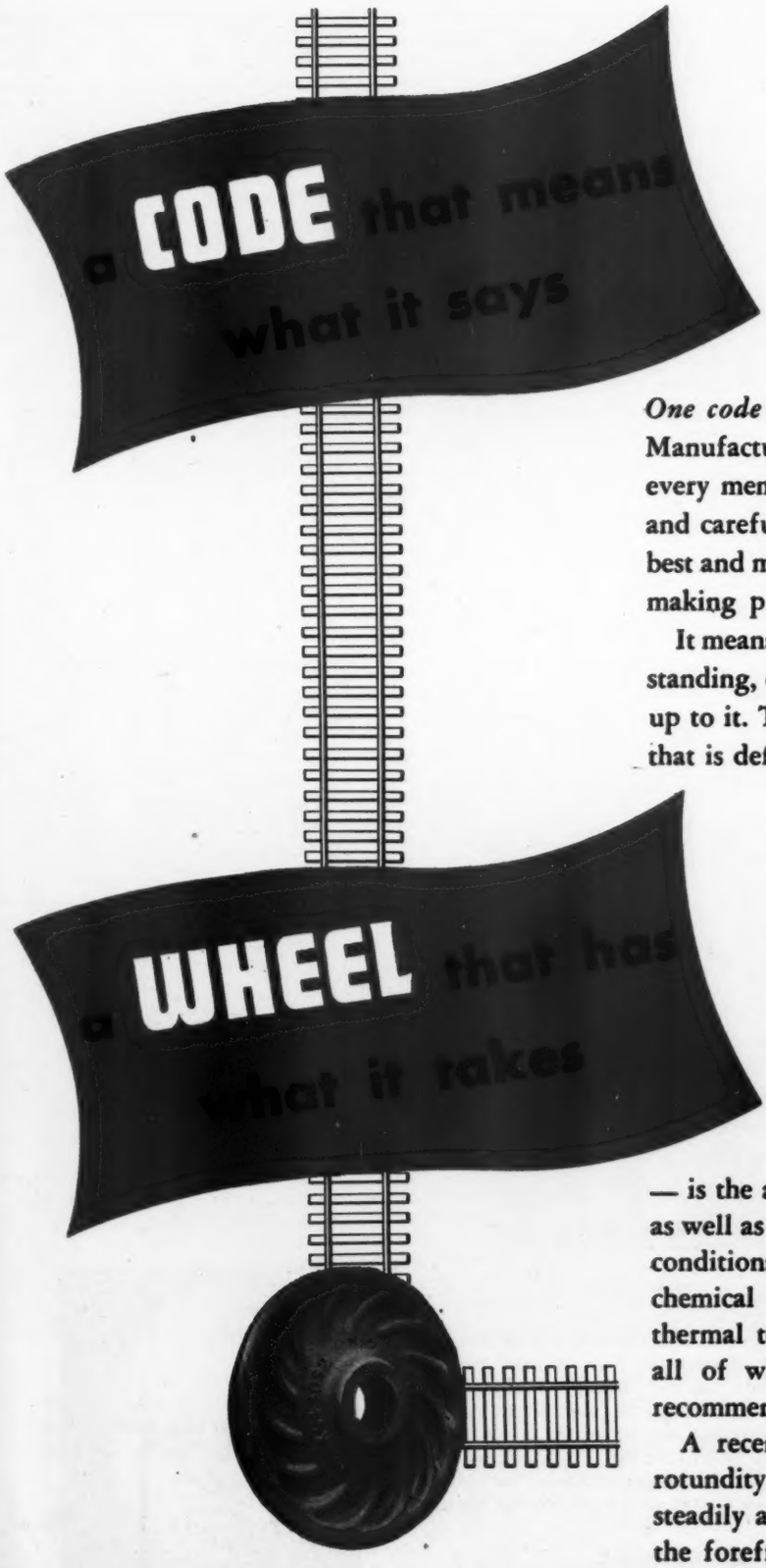
Edward G. Budd Manufacturing Company.—*Thomas R. Wagner,* formerly district sales manager in Chicago, has been appointed regional sales manager of the Railway division of the Edward G. Budd Manufacturing Company, with headquarters in the New York Central building, 230 Park avenue, New York. *Goodrich K. Murphy,* former district sales manager at New York, has been appointed assistant to the general sales manager, Railway division.

◆

Whiting Corporation.—The Whiting Corporation of Harvey, Ill., has moved its Pittsburgh, Pa., sales office to new and larger quarters in the Pitt Bank Building at Fifth and Liberty avenues.

◆

Homestead Valve Manufacturing Company.—*William E. Thomas* has been appointed division sales manager in charge of valve sales in the southeastern states territory, with headquarters in Atlanta, Ga., for the Homestead Valve Manufacturing Company of Coraopolis, Pa. Mr. Thomas formerly was southeastern division manager of the Chicago Metal Hose Company.



One code binds the members of the Association of Manufacturers of Chilled Car Wheels. It applies to every member without an exception. It is a specific and carefully worked out code embodying all that's best and most advanced in chill techniques and wheel making procedures.

It means what it says. In order to retain Association standing, each member manufacturer must fully live up to it. This gives American railroads an assurance that is definitely helpful in wheel selection.

— is the aim and accomplishment of AMCCW tests as well as AMCCW standards. Knowledge of service conditions determines chill block tests, drop tests, chemical analyses, processing temperature checks, thermal tests, rotundity tests and hardness tests — all of which are requirements rather than mere recommendations.

A recent depth-of-wear test for maintenance of rotundity has been added to this list. It typifies the steadily advancing standards that keep AMCCW in the forefront of railroad practice.

AMCCW

230 PARK AVENUE, NEW YORK, N. Y. • 445 NORTH SACRAMENTO BOULEVARD, CHICAGO, ILL.

Organized To Achieve: Uniform Specifications — Uniform Inspection — Uniform Product

4515

SAFETY CAR HEATING & LIGHTING COMPANY.—*H. W. Jones, Jr.*, has joined the Safety Car Heating & Lighting Co. as a sales representative in the Southeastern district, with headquarters at Philadelphia, Pa. Major Jones was born in 1921 at Renovo, Pa., and is a graduate of Lehigh University in industrial engineering (1942). He went directly into the Army Ordnance

Maj. H. W. Jones, Jr.

Department after graduation. In January, 1943, he was promoted to first lieutenant and in February, 1944, sailed for England with the Fifth Armored division as a captain. In December, 1945, he transferred to the Third Armored division. He returned to the United States in January, 1946, and was separated from the Army as a major in the Ordnance Reserve on March 31.

◆

ELECTRO-MOTIVE DIVISION GENERAL MOTORS CORPORATION.—The eastern region of the Electro-Motive Division of General Motors Corporation, with headquarters at 230 Park avenue, N. Y., has been reorganized. *Paul R. Turner* has taken over direction of the service and parts activities of the region, which formerly reported directly to the home office in LaGrange, Ill. Mr. Turner continues his responsibilities as regional sales manager. *O. L. Olsen* continues as eastern regional service manager, reporting to Mr. Turner. *Elmo Williams* is regional parts and stores representative, reporting to Mr. Turner.

◆

FLEXIBLE STEEL LACING COMPANY.—*Richard Y. Dakin* and *Morris B. Miller* have been appointed California sales representatives for the Flexible Steel Lacing Company, Chicago, and *E. R. Spragg* and *G. G. Spragg*, sales representatives for Washington and Oregon.

◆

EVANS PRODUCTS COMPANY.—The Washington, D. C., office and foreign department of the Evans Products Company has been moved to 1608 Twentieth Street, N. W.

◆

SINCLAIR REFINING COMPANY.—*Paul W. Zumbrook* has been appointed manager of domestic lubricating oil sales of the Sinclair Refining Company with offices at the company's headquarters in New York. Mr. Zumbrook has been lubricating sales manager for the central district with headquarters in Chicago since 1936.

STANDARD FORGINGS CORPORATION.—*R. W. Clansky*, vice-president and treasurer of the Standard Forgings Corporation, has been elected president, succeeding George E. Van Hagen, deceased. *James A. Cook*, vice-president in charge of sales, has been appointed executive vice-president, and *G. D. Bassett*, director of purchases, has been elected vice-president in charge of purchasing.

James A. Cook, the newly elected executive vice-president of Standard Forgings, was born at Louisville, Ky., on August 7, 1899. He entered the service of Standard in 1920 as a salesman at Chicago. In 1925 he was appointed manager of southwestern sales, with headquarters at St. Louis, Mo., and in 1934 general sales agent at Chicago. In 1937 Mr. Cook was elected a vice-president.

◆

CHICAGO RAILWAY EQUIPMENT CO.—*R. A. LeBeau*, recently released from the armed forces, has returned to the Chicago Railway Equipment Co., as district representative at Chicago.

◆

ELECTRIC STORAGE BATTERY COMPANY.—*John W. Weigt* has been appointed manager of the New York branch of the Electric Storage Battery Company to succeed *D. P. Orcutt*, who has retired after 36 years' service with the company. Mr.

John W. Weigt

Weigt, a graduate of Cornell, was an Army lieutenant during the first World War. He joined Electric Storage Battery in 1920 as a salesman in the New York branch, covering the industrial truck and locomotive fields. He later took charge of sales work in those departments. In 1944, he also took charge of railway battery sales.

◆

SPRING PACKING CORPORATION.—*John T. Landreth*, vice-president of the Spring Packing Corporation, Chicago, has been elected president of the company, succeeding John P. Landreth, deceased. *Stephen A. Mitchell*, general counsel of the firm, has been elected also a member of the board of directors, filling the vacancy left by the death of John P. Landreth.

The Chicago office of the Spring Packing Corporation has been moved from 310 South Michigan avenue to 122 South Michigan avenue.

SHERWIN-WILLIAMS COMPANY.—*Clarence B. Bull*, transportation sales representative at St. Louis, Mo., for the Sherwin-Williams Company, has been appointed general manager of transportation sales to succeed *W. J. Montgomery*, who is on extended leave of absence due to illness.

◆

STERLING ENGINE COMPANY; NATIONAL SUPPLY COMPANY.—The Sterling Engine Company of Buffalo, N. Y., has purchased the manufacturing and servicing rights to the high-speed Diesel-engines formerly produced at the Superior engine division of the National Supply Company, Springfield, Ohio. Production of the engines will be taken over by Sterling as soon as tools and inventory can be transferred from Springfield to Buffalo.

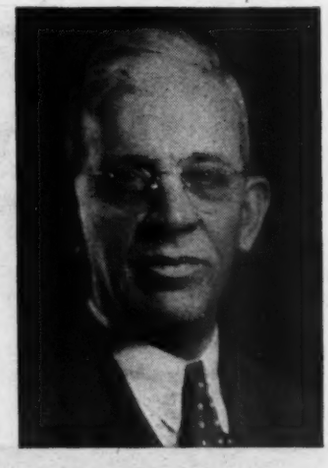
The Sterling Engine Company has opened a direct factory branch in San Francisco, Calif., to serve the territory west of the Rocky Mountains. *Hans Bohuslav*, vice-president and director of Sterling's engineering development and research, will be in direct charge of the new factory branch. He will be assisted by *Al Hahn*, who recently joined the organization. *B. Gordon Valentine* has been appointed chief engineer of the company.

◆

BALDWIN LOCOMOTIVE WORKS.—*Roland C. Disney* has been appointed manager of the eastern district of the Baldwin Locomotive Works, with headquarters in Philadelphia, Pa. Mr. Disney recently was released from army duty with the rank of lieutenant colonel. He is a graduate of Baltimore Polytechnic. He also attended Johns Hopkins University. He had been in the engineering department of the Western Electric Company for eleven years before being called to active duty early in 1941. Assigned to the Philadelphia ordnance district, he served as chief of the tank and automotive division and as assistant chief of the industrial division. Later he served in the European theater with the ordnance industrial division.

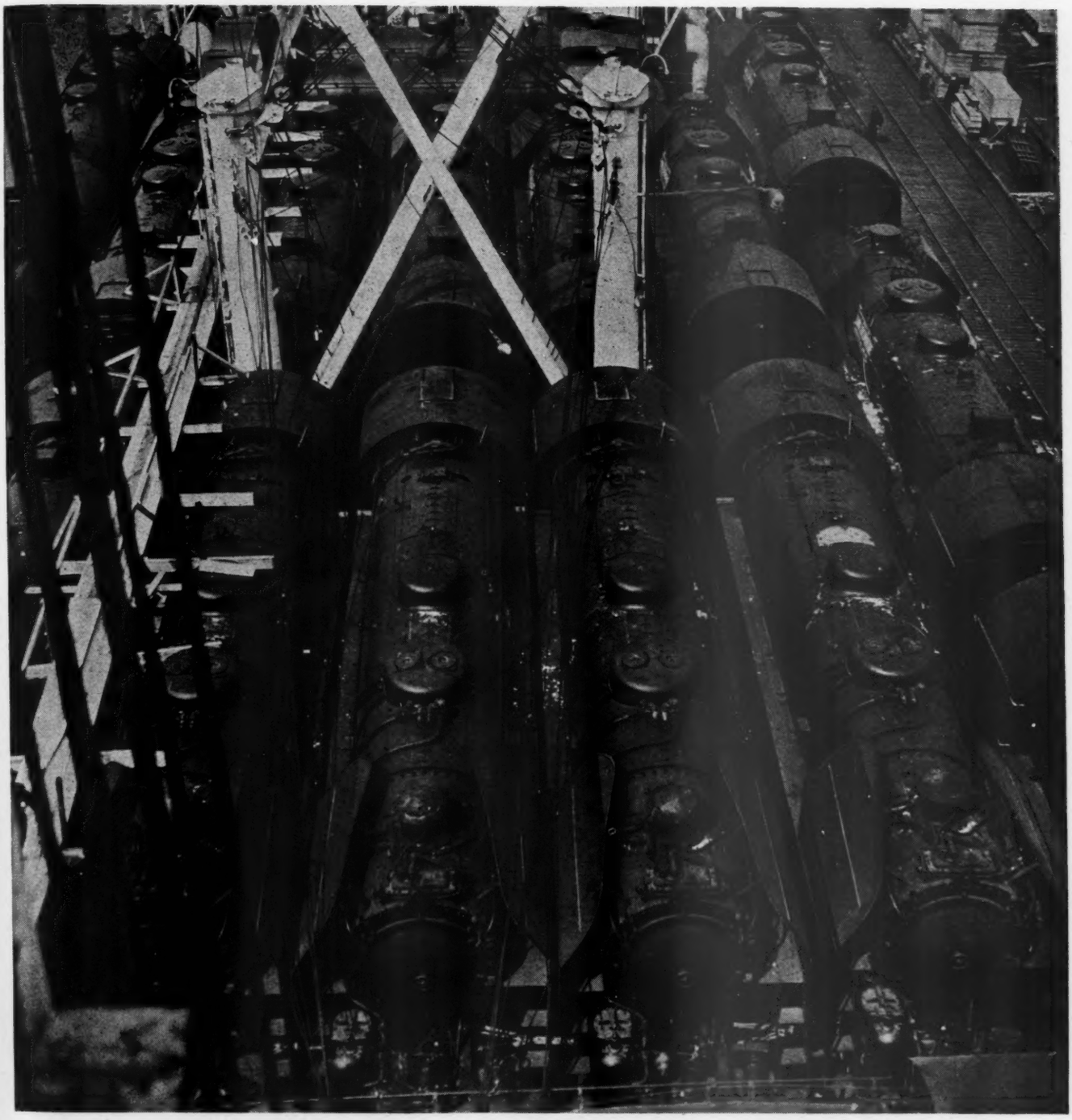
◆

FRANK C. CHESTON COMPANY.—*Frank C. Cheston* has organized the Frank C. Cheston Company, with headquarters at 38



Frank C. Cheston

Park Row, New York, to manufacture and sell electric rivet and metal heaters, with which products he has been associated for the past 26 years.



LIMA LOCOMOTIVES *for France*

ON JULY 31 of last year, Lima Locomotive Works, Inc. turned over to the French Supply Mission the first of one hundred eighty 2-8-2 steam locomotives which Lima is building for the rehabilitation of the French railway system.

Here the Belpareil, of Oslo, is ready to leave Weehawken, N. J. for France, completely loaded with a shipment of these especially designed locomotives.

LIMA LOCOMOTIVE WORKS INCORPORATED, LIMA, OHIO

WESTINGHOUSE ELECTRIC CORPORATION.—*Ellis L. Spray,* vice-president in charge of the elevator and air-conditioning divisions of the Westinghouse Electric Corporation at Jersey City, N. J., has been elected executive vice-president of a new organization, to be known as the B. F. Sturtevant Company, division of Westinghouse Electric. The manufacturing and engineering facilities of the B. F. Sturtevant Company, which was purchased by Westinghouse in September, 1945, are being integrated with the facilities of the Westinghouse air-conditioning division, which has been transferred from Jersey City to the Sturtevant main plant at Hyde Park, Boston, Mass. *G. C. Perry,* formerly vice-president of the Sturtevant Company, has been elected vice-president and general manager, and *E. B. Williams,* formerly vice-president of the Sturtevant Company, continues in that office.

◆

AIRCRAFT SCREW PRODUCTS COMPANY.—*D. Lynn Churchwell, Carl M. Henry* and *R. H. Wixson* have been appointed manufacturer's agents for the Aircraft Screw Products Company, Inc., Long Island City, N. Y.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*J. W. Sheffer* has been appointed general improvement engineer of the American Car & Foundry Co., with headquarters in New York. He has been with the company since 1908. *E. A. Watson* has been appointed assistant general improvement engineer; and *H. F. Schwarting* has been named general electrical engineer, with headquarters at St. Louis, Mo. *E. B. Carpenter* has been appointed district sales manager of the St. Louis office, succeeding *L. W. Martin,* retired.

The American Car and Foundry Company has established a Welded Products

J. W. Sheffer

division which will concentrate on the design, development and manufacture of weldments. This division of the company's manufacturing operations has facilities and equipment for automatic and hand welding, heavy forming machinery, heat-treating and stress-relieving units, metallurgical and physical testings, X-ray and magnaflux inspecting equipment.

The American Car and Foundry Company also has expanded and revamped its engineering division. A new sleeping-car section is preparing designs to fill orders placed by several leading railroads, and has been placed under the supervision of *J. W. Patton,* who was formerly employed as an architect by the Edward G. Budd Manufacturing Company. Mr. Patton is assisted by *D. R. Nichols, W. T. Griffin* and *E. E. Hansen.* Mr. Hansen came to the company from Curtiss-Wright at Columbus, Ohio, where he was chief production design engineer. In the industrial design section, *W. Boepple* is in charge of development work, under *Otto W. Kuhler. Aurion M. Proctor* is engaged in the development of interior equipment. *W. Elton Burnett, Jr.,* has been added to this section. Before coming to American Car & Foundry he was mechanical design engineer for Curtiss-Wright. *I. C. Barlow,* who has been with the firm since 1916, acts as coordinator between this section and the company's passenger-car building plants, with the title of assistant design engineer. At the Berwick engineering section, *H. A. Stevens* has been appointed assistant general mechanical engineer, reporting to the general mechanical engineer, *W. F. Dietrichson.*

◆

J. S. COFFIN, JR., COMPANY.—*George W. Usherwood* has been appointed Eastern sales representative of the J. S. Coffin, Jr.,

George W. Usherwood

Company, Englewood, N. J. Mr. Usherwood joined the New York Central in 1916 as an apprentice in the air-brake department, serving successively as air-brake foreman, assistant air-brake instructor, and air-brake instructor. In 1929, he became service representative of J. S. Coffin.

◆

RUST-OLEUM CORPORATION.—*Waldo E. Bugbee, W. D. Jenkins,* and *Frank M. Sweeney* have been appointed general agents in the railway supply field for the Rust-Oleum Corporation, Evanston, Ill.

◆

NATIONAL SUPPLY COMPANY.—*George B. Cushing* has been appointed manager of sales promotion for the National Supply Co., Pittsburgh, Pa. Mr. Cushing, sales promotion manager for the A. M. Byers Company for the past 17 years, will direct the sales promotion activities of National Supply Company, including the Spang-Chalfant, Superior Engine, and oil-field machinery and equipment divisions. These activities will include the advertising and market development programs of the company.

◆

UNION TANK CAR COMPANY.—*B. C. Graves,* executive vice-president of the Union Tank Car Company, Chicago, has been elected president, succeeding *L. J. Drake,* who has been elected chairman of the board of directors. *J. E. Harley,* assistant to the executive vice-president, has been elected a vice-president, and *A. E. Gebhardt* and *R. H. Lamberton* have been appointed assistants to the president.

Benjamin C. Graves was born at New

B. C. Graves

York on January 26, 1886. His business career began on February 16, 1903, when he became an office boy for the Union Tank Line (now the Union Tank Car Company). During the ensuing years he held various positions until, in 1922, he was elected a member of the board of directors. On August 12, 1925, Mr. Graves was elected a vice-president, and one year later became a member of the executive committee. On July 11, 1944, he was elected executive vice-president of the company.

◆

CHIKSAN COMPANY.—*E. T. Landgraff* has been appointed a member of the sales staff of the Chiksan Company of Brea, Calif. Mr. Landgraff's headquarters will be in New York. *Roy W. Sexton,* who has been a member of the Chiksan sales staff for the past three years, will be associated with Mr. Landgraff in the New York office. Mr. Landgraff has been connected with the Oil Well Engineering Company for the past 20 years, the last three as American representative. In addition to sales to the domestic market in the New York territory, he will serve as eastern representative of the Chiksan Export Company.

◆

RED HEAD PRODUCTS COMPANY.—*Allen Aikens,* sales representative of the Dockson Corporation of Detroit, Mich., has assumed active management of his own manufacturing concern, the Red Head Products Company, of Royal Oak, Mich. This company, formerly known as the Rich Red Head Rivet Set division of the Mott Steel Products Corporation, recently was purchased and reorganized by Mr. Aikens and moved to new quarters.

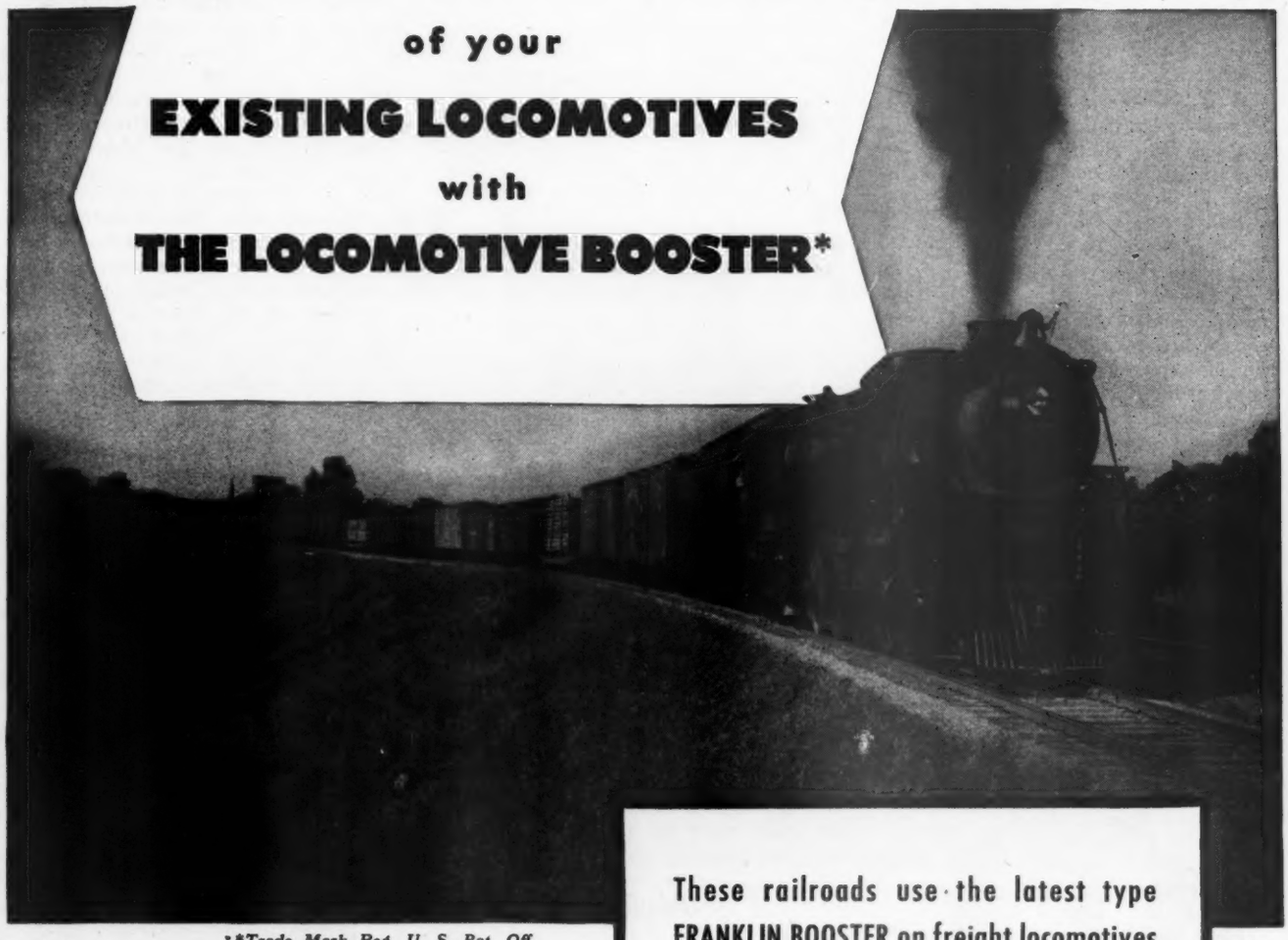
Step up the train load and speed capacity

of your

EXISTING LOCOMOTIVES

with

THE LOCOMOTIVE BOOSTER*



**Trade Mark Reg. U. S. Pat. Off.*

THE BOOSTER saves time by providing quicker pick-up. It enables the locomotive to accelerate rapidly to road speed and to maintain speed on grades. By making it possible to haul heavier trains at sustained speeds, it increases the earning power of the locomotive.

These railroads use the latest type FRANKLIN BOOSTER on freight locomotives

- Bangor and Aroostook
- Chesapeake & Ohio
- Lehigh Valley
- Missouri Pacific
- Pennsylvania
- Pittsburgh & West Virginia
- Reading
- St. Louis — San Francisco
- Soo Line
- Texas and Pacific

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

HEWITT-ROBINS, INCORPORATED. — The Hewitt Rubber Corporation has changed its name to Hewitt-Robins, Incorporated, thereby bringing in the identity of its wholly-owned subsidiary, Robins Conveyors, Inc. *Harold H. Von Thaden,* first vice-president of Robins Conveyors, was elected a director of the parent company.

◆

MODERN SUPPLY COMPANY.—*Robert E. Mann* has been elected president of the Modern Supply Company, Chicago, to succeed *E. A. Mann,* who has been made chairman of the board.

◆

AMERICAN ARCH COMPANY, INC. — *Charles Ringel,* assistant engineer of the American Arch Company, Inc., has been appointed mechanical engineer. Mr. Ringel began his career in 1911 as a special apprentice at the Roger Works of the American Locomotive Company, in Paterson, N. J. He completed his locomotive engineering course with the company in 1915, and then transferred to the engineering

C. Ringel

department of the Cooke Works. In 1920 he joined the engineering department of The Superheater Company in New York. In October, 1943, he again transferred to the engineering department of the American Locomotive Company at New York. In 1945 he became a member of the engineering staff of the American Arch Company, Inc.

◆

VAPOR CAR HEATING COMPANY, INC.— *O. A. Rosboro,* secretary of the Vapor Car Heating Company, Inc., has been elected vice-president and secretary, with headquarters as before at Chicago. *Franklin E. Hess,* northwestern manager at St. Paul, Minn., has been promoted to district manager, with headquarters at Philadelphia, Pa. He will be succeeded at St. Paul by *L. A. Richardson,* formerly engineer, with headquarters at Chicago.

◆

KENNAMETAL INC. — Kennametal Inc., Latrobe, Pa., has established a district office in the American Bank Building, 600 Grand street, Pittsburgh, Pa., to distribute and service its products in Western Pennsylvania and West Virginia. Field activities of Kennametal offices in Erie, Pa., Rochester, N. Y., and Syracuse will also be supervised from Pittsburgh. *Fred J. Hennig, Jr.,* is manager of the office. He will be assisted by *F. R. Dinger.* An office has also been established at 538 North Erie street, Toledo, Ohio. *E. D. Porter* is in charge.

◆

NATIONAL MALLEABLE & STEEL CASTINGS COMPANY.—*Archie J. Kashubeck* has been appointed district railway sales manager of the National Malleable & Steel Castings Company, with headquarters in San Francisco, Calif. Mr. Kashubeck began his service with National Malleable in 1916 in the engineering department at Cleve-

A. J. Kashubeck

land, Ohio. He was assigned to San Francisco as sales agent in January, 1945. Since 1929 he has been engaged in the development and sales of railway products, including draft gears for passenger cars and tight-lock couplers for streamline trains.

Obituary

EDWARD J. FINKBEINER, a vice-president of the American Car and Foundry Company, whose death was reported in the May issue, was 60 years of age. He joined the company in July, 1904, as a clerk in the auditing department at the Detroit, Mich., plant. He was transferred to the operating

Edward J. Finkbeiner

department in New York as general supervisor in the production department in May, 1922, and subsequently was associated with the president's office. He was a member of the Railroad-Machinery Club of New York and the New York Railroad Club.

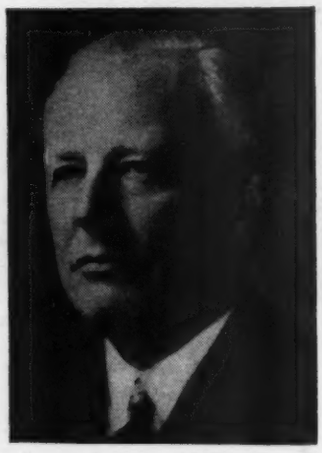
HARRY THOMAS BRISTOW, sales manager of the Safety First Shoe Company, Hollliston, Mass., died on April 11.

◆

GEORGE E. VAN HAGEN, president of the Standard Forgings Corporation, Chicago, died recently at Miami, Fla.

◆

WILLIAM CARTER DICKERMAN, chairman of the board of directors of the American Locomotive Company from March 1, 1940, until his retirement last December, died on April 25 at his home in New York. He was 71 years old. Mr. Dickerman was born in Bethlehem, Pa. He attended Penn Charter school in Philadelphia, Pa., and Lehigh University in Bethlehem, becoming a graduate of the latter in 1896. He then joined the Milton Car Works, Milton, Pa., where he served successively in the auditing, purchasing and engineering departments. In 1899, after the formation of the American Car and Foundry Company, of which the Milton Works became a part, he was appointed assistant manager of the Milton district of the firm. He was transferred to New York in 1900 and was general sales agent until 1905, when he was appointed vice-president of American Car and Foundry.



W. C. Dickerman

When this country entered the first World War, Mr. Dickerman was placed in charge of all war production of the company for the United States and the Allies. In 1919 he became vice-president in charge of operations. Mr. Dickerman was elected president of American Locomotive in 1929, and chairman on March 1, 1940. He served through the war years at the request of the board of directors, resigning as chairman immediately after the end of the conflict. He continued, however, as a director and a member of the executive committee. In the early 1930's, at the request of the late President Roosevelt, Mr. Dickerman became a member of the Business Advisory Council of the Department of Commerce. Lehigh University conferred upon him the degree of Doctor of Engineering in 1938. In 1945, Union College, Schenectady, N. Y., awarded him the degree of Doctor of Laws. Mr. Dickerman also was a director and a member of the executive committee of American Car and Foundry. In addition, he was a director of many other leading corporations, including the General

Veterans All!

The Burlington, first among railroads to put General Motors Diesel passenger power in regular scheduled service, would, logically, have a lot of *veterans* in this parade. Because the *longer* you operate any GM Diesel, the more records it piles up.

The 9907 B is but one of three other Burlington locomotives to operate more than 3,000,000 miles up to December 31, 1945.

Among the 27 Burlington *veterans* recorded, 19 had operated more than 1,000,000 miles; four more than 2,000,000 miles, and four more than 3,000,000 miles up to December 31, 1945.

All have operated an average of 1,831,994 miles, out of an average assignment of 1,935,996 miles for an average availability of 94.6%. Monthly average, 23,631 miles.

GM LOCOMOTIVES

Electric Company, the Carter Carburetor Company, the Superheater Company, the International General Electric Company, Inc., the Shippers Car Line Corporation, and the First Milton (Pa.) National Bank. Mr. Dickerman was for many years a member of the Newcomen Society of England, of whose London council he also was a member. He was a member of the American Institute of Mining and Metallurgical Engineers, and the American Society of Mechanical Engineers, in which he recently was bestowed a fellowship. For five years he was a councillor of the National Industrial Conference Board. He also belonged to the New York Railway Club, and was active in the Railway Business Association, of which he was a vice-president. Mr. Dickerman was president of Princeton University's Guild of Brackett Lecturers, before which, on April 14, 1931, he made an address entitled "The Steam Locomotive in America's Railroad Progress."

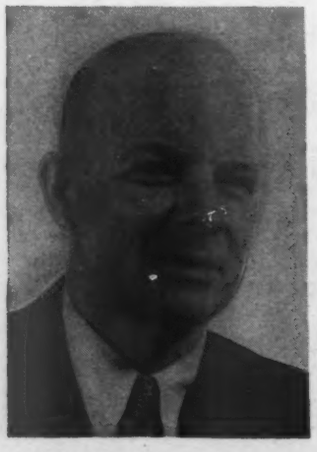
Personal Mention

General

W. H. WALTMAN, who recently resigned as supervisor of power plants of the Missouri Pacific at St. Louis, Mo., has been appointed engineer of shop plants and machinery of the Chicago, Rock Island & Pacific, with headquarters at Chicago.

F. THOMAS, supervisor Diesel locomotive maintenance of the New York Central at New York, has been appointed assistant to general superintendent of motive power, with headquarters at New York.

GEORGE A. BENEDICT has been appointed superintendent of motive power and equipment of the Alaska Railroad, with headquarters at Anchorage, Alaska. Mr. Benedict entered railway service in 1913 as a machinist apprentice, Cascade division, of the Great Northern. During the next four years he was a machinist on the Southern Pacific at Roseburg, Ore., the Chicago, Milwaukee, St. Paul & Pacific at Miles City, Mont., and Marmath, N. D., and the St. Louis-San Francisco at Cape Girardeau, Mo. In November, 1917, he entered the U. S. Navy and served through World War I. He returned in



George A. Benedict

1919 and for two years was a machinist on the Great Northern. In 1922 Mr. Benedict became a signal maintainer for the Union Switch & Signal Co. and the Western Pacific. A short time later he went with the Smith Manufacturing Company, San Jose, Cal., as a machinist. In November, 1935, he entered the employ of the White Pass & Yukon as a machinist and one year later was promoted to the position of master mechanic. In May, 1936, he was appointed assistant superintendent motive power and equipment.

J. W. COULTER, superintendent motive power of the Alton and Southern at East St. Louis, Ill., has retired.

JOHN T. DALEY has been appointed superintendent motive power of the Alton and Southern, with headquarters at East St. Louis, Ill.

LEO B. GEORGE, works manager of the Weston shops of the Canadian Pacific at Winnipeg, Man., has been appointed assistant superintendent of motive power and car department, western lines, with headquarters at Winnipeg.

F. C. RUSKAUP, assistant superintendent of equipment of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, Ind., has been appointed assistant general superintendent of motive power and rolling stock of the New York Central, with headquarters at New York, N. Y.

CLARE I. CLUGH, master mechanic for the Pittsburgh, Conemaugh, and Monongahela divisions, with headquarters at Pitcairn, Pa., has been appointed to succeed Mr. Harris as superintendent at Logansport.

WILLIAM T. ELMES, who recently returned from military service and was appointed roadmaster of the Pittsburgh & Lake Erie at Pittsburgh, Pa., has been promoted to the position of research engineer, with headquarters at Pittsburgh.

L. E. DIX, fuel supervisor of the Texas & Pacific, at Dallas, Tex., has been appointed acting mechanical superintendent, with headquarters at Dallas.

JAMES S. THORP has been appointed assistant to the president of the Delaware, Lackawanna & Western at New York. Mr. Thorp was born on February 1, 1885. He entered railway service in 1902 as machinist apprentice in the employ of the Southern at Spencer, N. C. He left to attend Virginia Polytechnic Institute in 1906. In 1912 he joined the New York, New Haven & Hartford as a draftsman on electrification. In 1913 he became assistant engineer of the Norfolk & Western. Subsequently Mr. Thorp served in electrification and engineering projects for various companies until 1923, when he joined the Illinois Central Terminal, Chicago, as distribution engineer, advancing to assistant electrical engineer in 1927. Mr. Thorp became electrical traction engineer of the D. L. & W. at Hoboken, N. J., in 1928, electrical engineer in 1930, and assistant to the vice-president of operations at New York in 1945.

Master Mechanics and Road Foremen

VICTOR GAGLIARDI has been appointed assistant master mechanic of the New York Central, with headquarters at Harmon, N.Y.

GREGOR GRANT, division master mechanic of the Canadian Pacific at Winnipeg, Man., has been appointed division master mechanic at Nelson, B. C.

H. R. HANSON, chief motor supply inspector of the Reading at Reading, Pa., has been appointed assistant master mechanic, Philadelphia division.

A. H. STOHLE, master mechanic of the Northern Pacific at Jamestown, N. D., has been transferred to the position of master mechanic at Spokane, Wash.

A. I. ANDERSON, general foreman of the Northern Pacific at St. Paul, Minn., has been promoted to the position of master mechanic, with headquarters at Glendive, Mont.

ARTHUR BAYNHAM, locomotive foreman of the Canadian Pacific at Winnipeg, Man., has been appointed division master mechanic, with headquarters at Winnipeg.

A. G. GEBHARD, whose appointment as general master mechanic of the Illinois Central, with headquarters at Chicago, was reported in the May issue, was born at St. Louis, Mo., on August 20, 1897. He entered the service of the St. Louis Terminal on

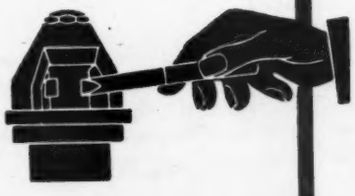
A. G. Gebhard

October 5, 1914, as an apprentice. Five years later he became a machinist and relief foreman in the employ of the Illinois Central at East St. Louis, Mo. He subsequently served as general foreman at various points until May 1, 1937, when he was promoted to the position of master mechanic at McComb, Miss. In 1939 Mr.

For Many Years to Come

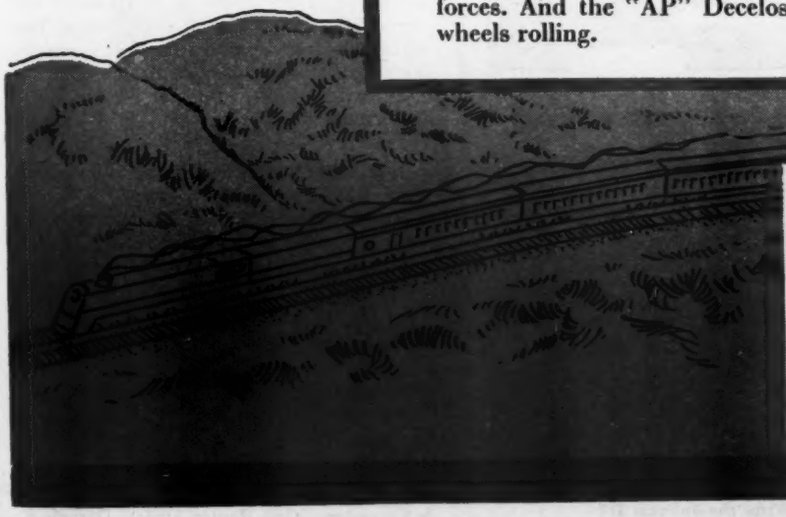
Cars Built Today Will Stay Modern *with*

"HSC" *Electro-Pneumatic Brake*



Planning for new passenger equipment embraces a long look ahead — as the future is always uncertain and a passenger car has a long-useful life. Will it run on close schedules? Will new competitive forces intrude and perhaps compel still closer schedules? Will braking be adequate? Will equipment be safeguarded at the higher speeds?

The control flexibility, which only the "HSC" electro-pneumatic brake offers, is of vital importance in present and future scheduling. It has its greatest appeal to operating officers faced with future operating uncertainties. The electro-pneumatic feature is a time saver that will reduce the schedule. Speed governor control will supervise the higher braking forces. And the "AP" Decelostat will detect wheel slip and keep the wheels rolling.



The best guarantee that modern cars will remain modern in an operating sense is to specify the complete "HSC" electro-pneumatic brake.

Electro-Pneumatic — Improves schedules with flexibility and smoothness.

Speed Governor Control — For control of high braking forces.

AP Decelostat — For anti-wheel sliding protection.

Westinghouse Air Brake Company

Wilmerding, Pa.

Gebhard was appointed to trainmaster of the Gulf & Ship Island (a part of the T. C.) and on May 1, 1940, was transferred to McComb. On November 1, 1940, he was reappointed master mechanic, with headquarters at Chicago.

Electrical

VIRGIL R. HASTY, whose appointment as electrical engineer of the Union Pacific, with headquarters at Omaha, Neb., was reported in the May issue, was born at Newport, Ind., on July 10, 1886, and received his higher education at Purdue University. He entered railway service in July, 1908, as a special electrical apprentice in the employ of the Union Pacific at Omaha, and in December, 1911, became an electrician. In June, 1917, Mr. Hasty was appointed electrician in charge of construction, shop and road work, Eastern district, subsequently holding various positions in the electrical department until June, 1939, when he became assistant electrical engineer at Omaha.

Virgil R. Hasty

Car Department

H. E. WAGNER has been appointed superintendent car department of the Alton and Southern, with headquarters at East St. Louis, Ill.

W. C. MEYER, assistant general car foreman of the Illinois Central at Centralia, Ill., has been appointed superintendent of car shop at Centralia.

HUGH H. YOUNG, superintendent of car shop of the Illinois Central, at Centralia, Ill., has been appointed superintendent of the car department, system, with headquarters at Chicago.

C. O. YOUNG, assistant to the superintendent of equipment of the Illinois Central at Chicago, has been appointed assistant superintendent of the car department, with headquarters at Chicago.

Shop and Enginehouse

R. M. PORTER has been appointed general foreman at the East Buffalo shops of the New York Central at Buffalo, N. Y.

P. E. WHITE has been appointed air-brake foreman at the East Buffalo shops of the New York Central at Buffalo, N. Y.

MARTIN RUSSELL, a machinist in the employ of the Canadian Pacific at Calgary, Alta., has been promoted to the position of air-brakes instructor, western lines, with headquarters at Winnipeg, Man.

WILLIAM DOUGLAS, assistant works manager at the Ogden shops of the Canadian Pacific at Calgary, Alta., has been appointed works manager at the Weston shops, Winnipeg, Man.

PETER BARON, division master mechanic of the Canadian Pacific at Nelson, B. C., has been appointed works manager at the Ogden shops, Calgary, Alta.

DAVID FRANCIS, locomotive foreman of the Canadian Pacific at Field, B. C., has been transferred to the position of locomotive foreman at Winnipeg, Man.

W. A. SLATER, draftsman for the Canadian National, has been appointed mechanical inspector for the Atlantic region, with headquarters as before at Moncton, N. B.

NORMAN WOOLLEY, air-brakes instructor, western lines, of the Canadian Pacific at Winnipeg, Man., has been promoted to the position of air-brake foreman at the Ogden shops, Calgary, Alta.

JOHN GENTLES, locomotive foreman of the Canadian Pacific at Bredenbury, Sask., has been transferred to the position of locomotive foreman at Field, B. C.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

LENSES.—Eastern Equipment Company, Willow Grove, Pa. Catalog Section No. AWP-21 descriptive of Amcoweld lenses for Specti-goggles, goggles, helmets and handshields.

◆

RAIL CARS.—The Buda Company, Harvey, Ill. Sixteen-page booklet, in four colors, describes new line of all-metal rail cars. Illustrates models, construction features, floor plans, and seating arrangements, with specifications and line drawings in the form of blueprints. Booklet available also in Spanish.

◆

TAP EXTRACTORS.—The Walton Company, 94 Allyn street, Hartford 3, Conn. Eight-page illustrated folder descriptive of Walton tap extractors for the quick and easy removal of broken pipe-threading taps.

◆

HOPPER CARS.—American Car and Foundry Company, 30 Church street, New York 8. Eight-page folder illustrates and gives principal weights and dimensions of three typical covered hopper cars built by the American Car and Foundry Company.

◆

COPPER ALLOY WELDING.—C. E. Phillips & Company, 2750 Poplar street, Detroit 8, Mich. Thirty-two-page handbook of materials and procedures in Welding and Brazing Copper and Copper Alloys, in three parts. Introductory section gives definitions of materials and processes; a table of compositions and properties of the most com-

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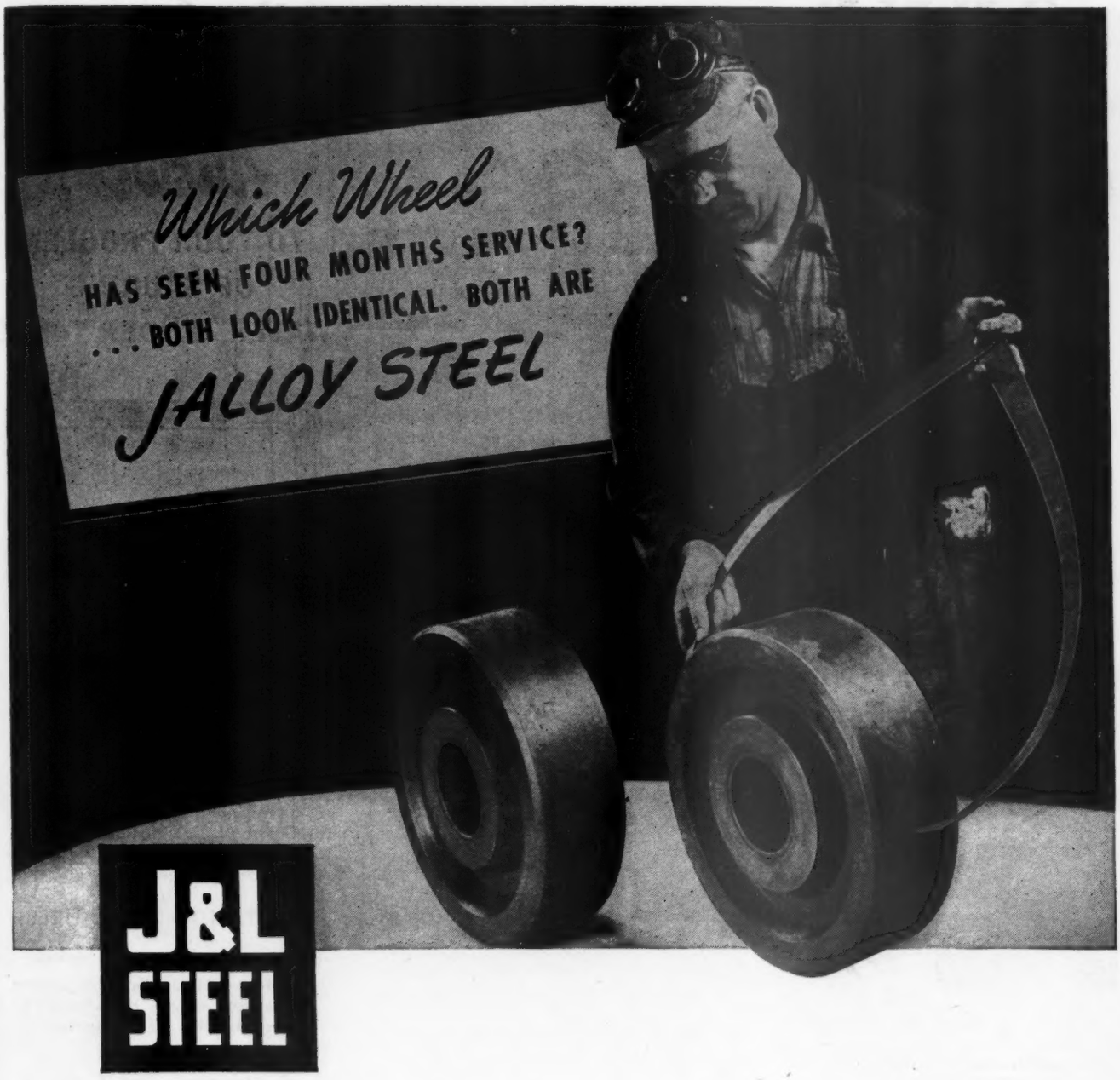

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◆

HELICOID GAGE.—Helicoid Gage Division, American Chain & Cable Co., Inc., Bridgeport 2, Conn. Sixteen-page catalogue, with cutaway photographs and line drawings, describes the Helicoid pressure gage, how it works, how it is put together, and the accuracy that may be expected from it.

◆

APEXIOR. — The Dampney Company of America, Hyde Park, Boston 36, Mass. Eight-page Bulletin 1400, printed in color, discusses three types of Apexior coatings for steam, Diesel, and Electric locomotives; for steam locomotive and stationary boilers, and for tender and tank interiors.

◆

OTISCOLOY.—Jones & Laughlin Steel Corporation, 311 Ross street, Pittsburgh 30, Pa. Sixteen-page, two-color illustrated booklet gives technical information, suggested applications, and other information on Otiscoloy, a new J & L weldable high-tensile, low-alloy steel.

◆

DRILL CHIP BREAKER.—Continental Tool Works, division of Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Mich. Six-page illustrated bulletin, No. 28161, describes and illustrates the Continental chip breaker and its advantages. Gives also installation and operating instructions.

◆

AIR-SEPARATOR.—The Swartwout Company, 18511 Euclid avenue, Cleveland 12, Ohio. Bulletin S-13 descriptive of the Airfuge combination air separator and trap for users of compressed-air tools and operations. Discusses need for clean dry air for the protection of pneumatic equipment.

◆

SIMPLEX JACKS.—Templeton, Kenly & Co., 1020 South Central avenue, Chicago 44. Sixty-four page pocket-size Catalogue No. 45.. Describes and illustrates conventional and special types of Simplex lever screw and hydraulic jacks in capacities from three to 100-tons. Specifications of dimensions, capacities, weights, etc., also given.

◆

THUR-MA-LOX. — The Dampney Company of America, Department T 22, Hyde Park, Boston 36, Mass. Four-page bulletin discusses Thur-Ma-Lox coatings which give protection to metal surfaces in power and process equipment at temperatures up to 1,600 deg. F.

◆

MILLING AND BORING MACHINES.—Kearney & Tucker Corporation, Milwaukee 14, Wis. Forty-seven page catalog No. E-53, illustrated. A short history of the company and its products is followed by a concise presentation of Kearney & Trecker line of milling machines, boring and milling machines, and their accessories and allied products. Line-drawings and two-color tables accompany machine specifications.

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